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MATÉRIEL FOR FIELD ARTILLERY FOR THE UNITED STATES ARMY.

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Second Artillery.

THE determination of the character of the *matériel* for the field artillery service of any country must be based upon its peculiar conditions and military necessities. It is here intended to present a consideration of the essential conditions and requirements as applicable to the service in this country.

Mobility.—When the conditions of field artillery service in this country have been maturely considered, the character of the country, nature of its roads, etc., it may be assumed that the degree of mobility for our service should be more perfect than that required for any in Europe, where the roads, and, in fact, all of the conditions incident to such service are so much more favorable than those with which we have to contend. Under no circumstance, then, should our standard of mobility be inferior to

the most perfect in Europe. It is equally imperative that the ballistic powers of our guns must be at least equal, and, if possible, superior to those of similar ones in any country, and that the supply of ammunition, with a battery, be ample.

Before accepting any measure of mobility, as presented by the practices of foreign services, it will be wise to scrutinize the conditions upon which it is based, and subject it to the well-established rules, and verify its argument with what is regarded as the powers of our horses for artillery purposes.

When this has been done, it is at once found that the loads imposed in almost every service in Europe, exceed those which we find ought to obtain in this country. The most noted exceptions being in Italy and Spain, due no doubt to the desire to reduce the load to the power of four animals in a team, and to the inferiority of the horses, or mules obtainable for artillery purposes. This increase of loads is unquestionably due to the character of the roads and of the country, as well as to the nature of the service. It is evident that each country has been governed by the conditions it expects to meet in actual war. Unquestionably we must be governed in like manner.

Artillery horse-power. — Our text-books and authorities all adhere to the rule that a horse of medium strength and good condition can draw a load, including the weight of the carriage, of 3000 pounds, from 20 to 23 miles a day, over a paved road; 1900 over a macadamized road; 1600 over ordinary roads, and 1100 pounds over rough or broken ground, or in the open country. A horse carrying a rider, loses his power of drawing in proportion to the increase of gait. This diminution, which is about one-half when the horse is at a walk, becomes two-thirds when he trots. In proportion as the number of horses is increased, the relative force of each couple diminishes, in consequence of the difficulty of making them act together, and the results obtained are respectively :: 9 : 8 : 7 : 6, according as the teams are composed of 2, 4, 6, or 8 horses. Hence, the teams are relatively stronger as their number is decreased. For artillery purposes in this country, the measure of a horse's power is taken as his ability, without a rider, to draw a load of 1600 pounds, including the weight of the carriage, 23 miles a day over ordinary roads, or 1100 pounds over the open country for any considerable distance. Hence, a team with a mounted driver will draw 2400 pounds, or 1200 per horse, and this load, with a team of 6 horses

at a walk, is reduced to 933 pounds per horse, or 800 with a team of 8 horses.

For field batteries it is a matter of grave doubt whether the team should ever exceed 6 horses under any circumstances. Even at the worst, when it is a question of exceptionally heavy roads or country, it would apparently be better to somewhat diminish the load by reducing the quantity of ammunition, and if necessary, increase temporarily the number of caissons, than to increase the number of horses in a team beyond 6. In horse artillery, and generally in field also, where the question of mobility is paramount, a team of more than this number is universally deemed inadmissible, for, aside from the impaired powers of the teams, exists the much greater objection to the great loss of maneuvering powers, as expressed generally, that the mobility is measured by the turning angle. This applies to the team and not to a carriage, as at present constructed everywhere, for any artillery carriage will turn shorter than can the most expert drivers safely turn a team of 6, or even of 4 horses going at speed. When the gait is increased to a trot, as must be the case with all kinds of field batteries, 6 horses are conceded to be the greatest number that can be used in a team to good advantage. At this gait the load becomes reduced to 829 pounds per horse, with which such a team can move at a trot for long distances over ordinary roads, and as to move at a rapid gait necessitates the transportation of the cannoneers, this load must, of course, include everything connected with a carriage. When the possibilities of bad roads, scant forage, and forced marches have been considered, this load should not be exceeded by any carriage in the field artillery services of this country, although it is 21 pounds per horse less than has generally been given as the maximum load, *i. e.*, 850 pounds per horse, derived, without doubt, from European experiences and authorities. In the open country, or over broken ground, the 1100 pounds per horse is reduced to 662 at a walk with a team of 6 horses, and a mounted driver to each pair, and to 570 pounds per horse when moving at a trot. With the former load this team can march at a walk over the open country for long distances, and for considerable ones at a trot. With the latter it can cover long distances at a trot, and considerable ones at a gallop. When each horse has to carry a rider, which has become a tactical necessity in case of exigency upon the modern battle-field, in order to transport with the greatest

possible rapidity a detachment of five men, the distance which the team can cover at the increased gait becomes considerably reduced.

These, then, may be considered as the limiting loads for our teams in field artillery service, and, although derived from the conceded power of a single horse of medium strength and good condition by the rules generally accepted in this country, they are found to be less than those applied in most European services. They cannot wisely be exceeded in our service.

ARTILLERY HORSE-POWER PER HORSE.

(Including weight of carriage.)

Kind.	4 Horses.	6 Horses.	8 Horses.	10 Horses.	12 Horses.
Horse.....	651 to 733	570 to 662			4 abreast on good roads. (English.)
Field.....	733 to 950	662 to 829	550 to 711		
Position.....	950	829	711		
Siege.....	1177	933	800	666	917
Train*.....	1303	1229	997		

* One driver, mounted on near horse.

From these we derive the limiting loads for the different carriages equipped for service in the field, assuming the gun detachment for field and position batteries to consist of 1 gunner, 1 caisson corporal and 6 cannoneers, to which must, of necessity, be added as many spare cannoneers as possible. The weight of a man is taken at 150, that of a knapsack at 20, and a paulin at 54 pounds. In horse batteries the number of cannoneers may be whatever is deemed best.

Position Batteries.—These are the heaviest found in a well-organized system of field artillery, and exist in every thoroughly organized modern army, generally as part of the corps artillery.

In a field of operations favorable to their employment, and from the nature and conditions of their services, these batteries usually have the advantages of the best roads in that field. Over an ordinary road an artillery team of 6 horses can draw a load of 829 pounds per horse at a trot for very considerable distances. Although it is not deemed absolutely necessary that position batteries should possess this degree of mobility, yet, if it can be secured with guns of sufficient power and provided with a sufficiency of ammunition, it will prove an invaluable addition to their efficiency.

As has already been stated, to maintain a trot for any considerable distance necessitates the transportation of the cannoneers in any battery. Heretofore in our services, provision has always been made for carrying 6 cannoneers upon a caisson, together with their knapsacks, etc.

Although a breech-loading gun possesses greater convenience for loading, and may more readily be served with fewer men, decided objections exist to making any reduction in the personnel of any battery, and especially is this so in face of the fact that the number of caissons, and consequently the number of horses to be cared for must be increased. The total number of men formerly required for service in a battery varied from *twenty* to *thirty* per piece, and it was held that the number for field service should never be less than twenty-five, even in the old 6-pdr. batteries. In European armies, where trained men are supplied to batteries to replace casualties, with the same facility and promptness that rations or other supplies are provided, a greatly reduced number from any above indicated is permissible. But this feature is one upon which we never can expect to place any dependence whatever. All English and American artillery officers of experience have very decided ideas respecting the care of *matériel*, and especially of the horses, which they hold to be matters of first importance to insure efficient service, and that this cannot be secured without a large number of men. These officers have always strongly demurred to any reduction, and look with horror upon any proposition having that end in view. At first few English officers looked with favor upon the acceptance of a breech-loader when coupled with a condition to reduce the personnelle. Of course, the horse batteries can retain any desirable number of men, but it will be found that the number that can be carried upon the caissons will reduce the number in field to 20, and in position batteries to 23 men per gun, including non-commissioned officers, drivers, artificers, etc.

To this must be added, however, such men as are necessary to care for the spare horses, and it will, in view of the above reductions, go hard with battery commanders if they do not fully demonstrate the necessity for having at least one spare cannoneer for each such horse, and for our service this will unquestionably not give as many men as are really necessary to keep the horses in the best condition. In *position batteries*, a rapid gait is not required in the open country, and there exists no necessity for

carrying the cannoneers as in field batteries; at the same time the gun must possess the maximum of power. Each caisson for these batteries ought to carry at least 4 cannoneers, 5 knapsacks, and a paulin, besides, of course, the usual equipments of the carriage, so that the limiting load for the caisson equipped for service — this is always understood to include tools, implements, equipments, paulin and ammunition, etc.—but without the cannoneers or their equipments, will be 712 pounds per horse, and if we can keep within or reasonably near this limit, a battery of even this exceptionally heavy character will possess a sufficient degree of mobility to move at a trot for quite long distances upon ordinary roads. But it is evident that this load must be confined to the caissons and carriages other than the gun-carriages. These, as already indicated, follow the main or best roads, and generally find their positions for battle not far therefrom. They are not required to move in the open country faster than a walk to secure position, nor to carry cannoneers in so doing. The team can move for considerable distances over ordinary open country at this gait with a load not exceeding the 829 pounds per horse for the caissons, and should be as much within this limit as possible. For the position gun, the heavy 12-pdr. of our field artillery system prior to 1861, the load per horse was 744 pounds. As this was considered, by experienced artillery officers, to be the limiting load for this gun in our service, it may here be accepted as the maximum permissible. Attention should be called to the fact that no knapsacks are to be carried upon any of the limbers. With the gun-limbers this is absolutely necessary in order to leave as much weight as possible for the gun and its carriage. They should never be carried upon the limbers, as this practice results almost inevitably in sore necks upon the wheel-horses.

This practice is, of course, not altogether responsible for this grave evil. Heretofore, in our service, the want of a suitable road-brake, has been in a great measure also the cause for it. There is hardly to be found in America a work wagon unprovided with this absolutely indispensable device, nor is it believed are any foreign field artillery carriages unprovided with it. Beyond the question of a doubt, no such carriage for our service will meet the approval of artillery officers, unless it be provided with a suitable brake for use upon the road. That the present recoil-brake for the 3″.2 gun, though admirably adapted for this single

purpose—is entirely unsuited for service upon the march—was long ago pointed out by the Ordnance Board, and its present form is little if any better than as originally devised, and is entirely out of the question for horse artillery.

In *field batteries*, to enable the team to move at a trot for considerable distances upon ordinary roads, the loads must not exceed 829 pounds per horse. But from the nature of the services of these batteries, they will not always be able to secure the use of equally good roads with the position batteries, or even of the ordinary roads of the country for which this load is calculated, hence, not more than 800 pounds per horse, at most, should be assigned; the caissons, 9 in number, each having to carry 3 cannoneers and 6 knapsacks, as in these batteries there are 5 cannoneers carried upon the gun-carriage. Without these, the limiting load for the caisson will be 705 pounds per horse. To enable the gun team to move at a trot in the open country the load must not exceed 662 pounds per horse. Formerly the caissons accompanied the pieces up to their positions for battle, and carried most of the gun detachment. But this is no longer practicable. Modern requirements and tactics provide for maneuvering the guns much more independently of the caissons, and this has necessitated the carrying upon the gun-carriage of a sufficient number of men to serve the piece, and, by the aid of two seats, five men are so carried. This has also been found to distribute the loads quite equally throughout the battery for long and rapid marches upon the road, but when it is attempted to apply it upon the battle-field, it is found that it will result in a gun and carriage far too light to meet the demands of modern service. The universal way out of the difficulty is to first secure as heavy a gun as is permissible, and then to obtain a sufficient degree of mobility by adopting permanently an expedient which has often been resorted to in old times in cases of emergency, *viz.:* put two men upon the gun-limber, and mount the other three upon the off-horses of the team. This reduces the powers of the team somewhat, but the maximum load is adhered to at the expense of the distance which can be covered at the increased gait. This gives the limiting load for the gun-team as 612 pounds per horse, and any increase over this will proportionally reduce the distance which the team can cover at a trot in the open country, already reduced, from the necessity for making every horse in the team carry a man.

In *horse artillery*, to enable a team to maintain its place with cavalry upon long and rapid marches, and to enable the team to move at a trot for long distances over ordinary, or, perhaps, indifferent or bad roads, the load must not exceed 662 pounds per horse, with which the team can move at a trot for considerable distances in the open country, and even at a gallop for short distances. This, then, is the limiting load for the caissons, equipped ready for service in the field, and as it has no equipments to carry for the cannoneers, no foot-boards nor such like-appliances of this nature as the other batteries are provided with are required here, and they must all be removed. Otherwise they will surely become harboring-places for unauthorized weight. The cannoneers carry their equipments upon their horses, and in this respect have a very great advantage over the cavalry, in that they have no arms nor ammunition to carry. To enable the gun team to move at a gallop for some distance in the open country, the load must not exceed 570 pounds per horse. In former times the team could be loaded up to the limit if desired, with the gun, carriage, ammunition, etc., as then the detachment rode up with the gun to its position for battle.

But the advent of the long-range rifle-musket, and other modern conditions of battle have changed this, as with the field-gun. The demand for power to subdue the fire of the enemy, check his advance, demolish his rifle-pits, etc., has led to such increase in the weight of the field-guns, though still kept as near the limit as possible, that, in order to secure a supply of artillery with sufficient mobility to quickly aid and sustain the infantry attack, and to meet the other ordinary exigencies of the modern battle, more than half of the horse batteries are now restricted to service with that arm. To advance with it in the face of modern fire with the detachment mounted upon the horses, has been found to be impracticable, and these batteries have, under many circumstances, been forced to resort to the same expedient as the field batteries: mount three of the cannoneers upon the off-horses, and carry the other two upon the gun-limber.

To insure the required degree of mobility, it is evidently necessary to deduct the weight of these two men from the above load, and when this has been done, the limiting load is reduced to 520 pounds per horse, with the same impairment of the horse-power as indicated for the field-gun team. To get down to the limit, the drivers and cannoneers in European horse batteries are

selected with the care which a trainer exercises in the choice of his jockey, and none but light, strong, and active men are permitted as cannoneers. Where they have so many thousands from which to choose, of course they have a decided advantage over us in this respect. With or without these advantages, we are under even greater necessity than any service in Europe, not only to secure this limit of load, but to get as much within it as possible. For those horse batteries which have to serve with the Corps Artillery, this necessity is manifestly imperative, and it is no doubt equally so for those which are to serve with the cavalry, but for other reasons. However, all such batteries must be alike; to construct one kind for service with cavalry alone, and another with infantry is entirely inadmissible.

One great feature of future wars will be the efforts to destroy property, and interrupt communications, etc., by means of raids and other extended cavalry or mounted infantry operations. Even when not organized upon a large scale, they are certain to exist upon a small one, for the destruction of railways, bridges, depots, etc., protected by block-houses, or other slight works armed with machine guns. The enemy so protected and armed will be enabled to bid defiance to such force unaccompanied by artillery, but would have to succumb in short order when subjected to its fire. Such bodies of troops would move with the greatest rapidity, even upon indifferent roads—which, indeed, would be preferred as the most unfrequented and least guarded—and no artillery would be of any service whatever except it possessed the maximum degree of mobility. For extraordinary occasions a battery, or part of one, possessing this essential requirement of service, without caissons, will meet this demand, and will be able to march as fast and as far as any cavalry under whatever circumstances, and with larger commands the complete battery will be able to do the same.

The cavalry leader is not responsible for the mobility of the battery, but should be bound to force his march to the limit of the powers of his own arm of the service, and if this indispensable charasteristic of the horse battery be not perfect, the result will be either to delay or impair the object of the leader, or, by overtaxing the powers of the battery horses, ruining them or rendering them unfit for further service for a time.

Mountain batteries.—The *matériel* for these batteries must be based upon the powers of the pack-mule. There appears to be

considerable diversity of opinion as to what this power is. In the Report of the Chief of Ordnance, 1886, p. 477, the maximum load for an animal of the supply pack-train is given as 300 pounds, exclusive of the pack-saddle. General Holabird, Quartermaster-General, asserts that the average load is 200 pounds. In the English service in India the loads, including saddles, run from 290 for a gun, to 353 pounds for an ammunition pack. The animals selected for this service will, undoubtedly, be much above the average, at the same time, as with other kinds of artillery, to insure the requisite degree of mobility and efficiency of service, the load must be reduced considerably below the maximum, and especially must this be so respecting those packs which from their nature remain permanent, or prove to be bad packs, such as the gun, and especially the carriage-pack. By practical packers in this country, 300 pounds, including the weight of the pack-saddle, is considered a heavy load even for good animals, and for mountain artillery service this may be considered as about the maximum, even for the ammunition-pack, which is, however, an "expendible" one.

Unquestionably, the pack-saddles must be as light as the nature of the service will permit. Those here assumed are given in the above-mentioned Report, pp. 486-7, *viz.:* gun, 65; carriage, 62; wheel, 60; and for the ammunition pack-saddle, 58 pounds respectively, but there must be added to these for a pioneer, 75, and baggage pack-saddle, 56 pounds respectively. The weights for the English-Indian saddles vary from 73 for the gun, to 91 pounds for the pioneer and baggage pack-saddles. But even the weights assumed appear unnecessarily heavy as compared with the old U. S. 50, or the Krupp saddle of 46.5 pounds. At least six different kinds of saddles are required as indicated, and if the axle of the gun-carriage is so long as to require unshipping, a seventh will be required. The weight of gun varies from Krupp's 2″.36 gun 198, Russian 2″.5,216, Krupp's 2″.95,227, to the French 3″.15 gun of 231 pounds. The English 2″.5 gun is in two parts of 200 pounds each. The weight of the old U. S. mountain gun was 214 pounds, which was no doubt considered by experienced officers to be the limit of weight permissible in our service. The weights for the English light carriage-bodies are 161 and 192 pounds respectively, and of Krupp's carriages complete — with wheels — 178 and 322 pounds. The weight of wheels is not known, but the carriage-bodies must be

extremely light for such guns. The weight of carriage-body complete, with implements, etc., here required, will not exceed 186 pounds, with 126 for the wheels, total, 312 pounds for the carriage complete. The weight of projectile is 12 pounds, which is that adopted by our predecessors, and we are in as much need of an equal weight as they could possibly have been. Besides, it is found convenient in making up a suitable pack, a matter of no inconsiderable importance. The caliber determined by the conditions of weight, pressure in the bore, etc., is 2″.74, with a charge of 1.1 pounds. This, if at all practicable, should be contained in a metallic cartridge, perhaps compressed and perforated through the middle with suitable means to insure ignition, in order to secure reasonable pressure in the bore. This would also reduce the length of the cartridge, and also of the chamber of the gun, both very important considerations. The English 3″ 200-pound gun fires a 12-pound double shell, and the Shrapnel for the French 3″.15 gun weighs 12.54 pounds. The length of cartridge will be about 15 inches, and a box containing 4 rounds would be about 4.5×6.75×33 inches, and should be limited to a weight of 10 pounds. One for 3 rounds to go with the wheel-pack, 4.5×9.75×18 inches, weighing not more than 8 pounds, these boxes to be discarded when empty, save, perhaps, the special ones for the wheel-pack, which should always be kept filled. With 16 rounds the load will be 314 pounds, which is, no doubt, the maximum permissible. The English allowance of ammunition for the 3″ 200-pound, 6-gun battery, is 135 rounds per gun, with the battery.

To secure a carriage within the limit of weight may necessitate a reduction in the track of the wheels to the minimum, in order to secure a strong axle, otherwise the axle will have to be made to unship, as in the Russian and English services, thus requiring an additional animal for each gun. It is claimed, however, that the delays in passing through woods, narrow defiles, etc., are much greater than those imposed by having to ship the axle upon going into action, and the additional animal, in fact, carries a considerable load aside from the axle. With a fixed axle its length should not much exceed 30 inches, giving a track of about 24; all that is required is enough to insure sufficient stability for the service of the piece in action. As in all other batteries, spare animals will be required to replace those killed or disabled from any cause, or for relief; this fact renders it un-

necessary to provide for wheel transportation, even if more cogent reasons did not preclude this idea. To control the recoil, Colonel Buffington's recoil-brake will serve admissibly, as it will not be required for a road-brake also.

The gun will be very similar to that of the Russian service, as well as those of several other nations, and a strong contrast to the present 1″.65 Hotchkiss so-called mountain-gun which, with a projectile of only 2.19 pounds weight, without a time-fuse, is not properly to be classed with mountain-guns at all, and even if it were its projectile is less than one-half the weight of the lightest proposed in any service and not one-fourth the maximum deemed necessary, while its want of a time-fuze renders it almost entirely valuless for such service.

An English 6-gun mountain battery consists of: 1 major, 1 captain, 3 lieutenants, 1 surgeon, 1 veterinary surgeon, *2* staff sergeants, 6 sergeants, 6 corporals, 6 bombardiers, 2 trumpeters, 90 gunners, 57 drivers (and 94 hired drivers), 1 farrier, 3 collar-makers, 3 wheelers, and 3 shoeingsmiths; aggregate, 179 (total, 273 men), with 18 horses, 112 ordnance- and 86 baggage-mules; total, 211 animals. Of these, 36 ordnance- and 12 baggage-mules are "relief," and 24 are spare animals. The relief animals, however, carry the line gear, etc., of the mules they relieve.

For the weights heretofore indicated, our loads will be as follows:

First Animal,	Gun pack-saddle complete.....	65 pounds,
	Gun.....	214 "
		Load, 279 pounds.
Second Animal,	Carriage pack-saddle complete.....	62 pounds,
	Carriage complete.....	186 "
		Load, 248 pounds.
Third Animal,	Wheel pack-saddle complete...	60 pounds,
	Two wheels....	126 "
	6 rounds, 81; 2 boxes, 16.....	97 "
		Load, 283 pounds.
Fourth Animal,	Ammunition pack-saddle complete...	58 pounds.
	16 rounds, 216; 4 boxes, 40.....	256 "
		Load, 314 pounds.
Fifth Animal,	Pioneer pack-saddle complete.....	75 pounds,
	Tools, etc.....	225 "
		Load, 300 pounds.

Sixth Animal,	Baggage pack-saddle complete.....	56 pounds,
	Baggage, etc.....	224 "
		Load, 300 pounds.

A 6-gun battery will require 48 ammunition mules for a supply of 134 rounds per gun—counting the 6 carried with the wheels—18 mules for the guns, carriages and wheels, with 24 relief or spare animals, total, 90. Baggage: officers, 3; men (2 per detachment), 12; cooking, 4; stores, 6; office, 1; medical and veterinary, 1; forge, 1; pioneers, 2; artificers, 2; spare, 12; total, 44; aggregate, 134 mules, to which must be added the horses for the officers, and for the non-commissioned officers and men when mounted.

The gun and carriage complete will weigh 526 pounds. The modern mountain-gun, with suitable Shrapnel, is more effective up to 2000 yards than was our old 3″ rifle in its day, and quite its equal up to 3500 yards. While the pack outfit indicated seems exaggerated as compared with that for the improvised and so-called 1″.65 Hotchkiss mountain battery, considering the power of the gun, and, as compared with the material and equipment, etc., of the 3″ rifle battery, this outfit becomes one of remarkable simplicity, size, and mobility.

These are the limiting loads for the different elements of the various batteries based upon the accepted powers of the horse, as applied to artillery service in this country, under the conditions as to the number of cannoneers to be carried. Any increase above them must inevitably result in a proportional loss of the requisite degree of mobility. In Europe, on account, no doubt, of the excellence of the roads and other favorable conditions, it is generally found that these limits are exceeded, especially as applied to the caissons, in order to secure a more powerful gun, and yet retain for it the requisite degree of mobility, while still carrying a sufficient number of rounds. The permanent load for the caissons is also greater, just as those here derived are greater than those which have heretofore obtained in our service, and for precisely the same reasons, viz,: a reduction in the number of cannoneers carried upon it. The foreign conditions being more favorable, this reduction is greater than has here been deemed wise, resulting in a corresponding difference in the permanent loads. We cannot rely upon any such favorable circumstances, and are therefore under great necessity of keeping within our own

limits in all cases, and at the same time must have the most powerful gun with a sufficiency of ammunition. As the chain is no stronger than its weakest link, so with the mobility of a battery. In the old 12-pdr. battery the heaviest carriage was 663 pounds per horse, the battery wagon 819. However convenient it proved to be in camp, upon the march this perfection of a horse-killing machine was a constant terror to every battery commander. Under no circumstance must the forge, battery wagons, etc., exceed the limiting loads for the other carriages. With the field and position batteries, when traveling at a rapid gait, each will haveto carry three artificers, and the weight must not exceed that for a caisson in a field, while it may be 25 pounds per horse more than for the caisson in a position battery. The team for the baggage wagon may be driven from a seat upon the wagon, when the horses may be weighted up to 733 pounds per horse in a team of four, including the wagon and everything upon it.

ARTILLERY LOADS, PER HORSE.

	GUN CARRIAGES.			CAISSONS.		
	H. A.	F. A.	P. A.	H. A.	F. A.	P. A.
	LBS.	LBS.	LBS.	LBS.	LBS.	LBS.
Limiting Loads.....	520	612	779	662	705	712
Cannoneers mounted	570	662	829	662	800	829
Old U. S., 1860....	531	644	744	582	635	643
Cannoneers mounted	531	729	828	582	805	813
Lightest in Europe.	509	682	770	543	776	787
Cannoneers mounted	559	732	820	543	871	882
	Spain.	Russia.	Russia.	Spain.	Germany.	Russia.

It will be observed that the field-gun appears much lighter than that of 1860, but it must be remembered that the 662 pounds per horse only obtains when three cannoneers are mounted upon the off-horses. When the five cannoneers are mounted upon the carriage for rapid marching upon the road, the load becomes 739 pounds per horse, or actually 10 more then the load for our old gun. These loads were deduced without any reference to those formerly obtaining in our service. However much they may vary from the old ones, respecting the permanent loads, it is naturally to be expected that the maximum ones will approximate very closely to the old ones, as the basis of calculation is probably the same in both cases. The character of the old 6-pdr. and its ammunition enabled our predecessors to get well within the limit for horse artillery under the then existing conditions. But, under

present ones, we are actually restricted to still narrower limits both for horse and field-guns, and at the same time must secure a vastly more powerful gun. It is perfectly evident that there is absolutely no room whatever for even a single pound of extra or unnecessary weight in any of the elements for these batteries, and that to secure satisfactory results entails the perfection of material, combination and construction. The limits, though changed by new requirements, are of course practically the same as for our old artillery service, the roads and the country remain the same, as does the character of the horses, consequently the present workers in the cold steel which is to form this material are bound to keep within these limits with the same care and with the same measure of success as was secured by their predecessors, and by just as much as these limits are exceeded, by that much will the resultant want of mobility and inefficiency in the battery be measured.

Ammunition.—The highest number of rounds per gun in modern practice is found in the French service, viz. ; for horse, 160; field, 138 and for position batteries, 118 rounds per gun, with 30, 26 and 18 in the limbers respectively. This supply is apparently small as compared with the old standards. But when proper methods are followed such is not really the fact. Such a reduction in the number of rounds would manifestly be wholly inadmissible, if the inefficiency of fire were proportionately reduced. Such reduction is only permissible upon condition that this efficiency be maintained or increased. For instance the old 3″ rifle carried 72 rounds in the limber. For purposes of ready comparisons suppose 80 per cent. Shrapnel and the remainder common shell, and that the iron gives five fragments per pound. To secure an effective range of 4000 yards the bullets in the Shrapnel would have to be 21 to the pound, and with the very low velocity of this gun the shell will contain not less than 37 per cent. of its weight in bullets. These 72 rounds will then represent 6947 missiles or projectiles, which is the measure of efficiency for the gun. It is desired to substitute a new gun, and of course to improve upon the old one. To secure increased range, it may be held permissible to reduce the number of missiles proportionately, but as this additional range is for the least valuable part of the tragectory, such reduction must be small. The new 3″.2 gun with 40 rounds in the limber, of 13 pounds containing 107 bullets 32 to the pound or 25 per cent. gave 4930 projectiles, 2017 less

than for the old 3″ rifle, but with an increased effective range. This is manifestly an improper reduction in the number of projectiles. But with 40 rounds in the limber the 3″.2 gun is considered wanting in mobility, and to reduce the weight to about 3700 pounds, it is proposed to reduce the number to 30 without any change in the projectile. Thus it is proposed to sacrifice 25 per cent. of the most valuable quality in a battery, in order to secure a comparatively insignificant increase of mobility. The measure of the improvement upon the old 3″ rifle as secured by new 3″.2 gun and the one here proposed is represented as follows:

Guns.	Old 3″ Rifle.	New 3″.2.	Prop. 3″.45.
No. projectiles in limber.....	72	30	26
Weight of projectile, lbs.....	10.5	13	21.2
Per cent. of bullets in shrapnel.....	37	25	43
Bullets per pound.....	21	32	64—90
Bullets in shrapnel	81	107	580—819
Total bullets....	4,798	3,210	14,468
" fragments.	2,149	650	1,800
Total missiles...	6,947	3,860	16,268

With respect to the actual value of the number of rounds per gun carried with a battery, under the same conditions as will hereafter appear for the proposed field gun, the 3″.2 would have 208, and the former 150 rounds each, apparently 27 per cent. in favor of the 3″.2 gun. But the 208 rounds represent less than 37,000 missiles, while the 150 rounds for the other gun represent over 93,000, or, to make the comparison fair, taking a single shrapnel for each gun, over 53,000, and the apparent 27 per cent. in favor of the 3″.2, is reversed, and is really 29 per cent. in favor of the other. The quantity may signify little or nothing; the quality of the projectile must necessarily signify everything.

In order to secure good ballistic results, it is necessary to make the weight of the elongated projectile as many times as possible that of the cast-iron sphere of equal caliber, *i. e.*; reduce the value of d^3/w. This is the only practicable means whereby we can secure the necessary *terminal* velocities, and at the same time make use of the minimum of pressure in the bore of the gun, which will secure the necessary initial velocity, and at the same time permit of the construction of light carriages. While such ratios for seacoast guns can be found as high as 4 .5, in field artillery, where the same end is to be secured, *i. e.*; great power at long ranges, but with the greatly increased absolute necessity for light guns and car-

riages, there is the same necessity for a high ratio. With seacoast guns it has been found necessary to make use of this high ratio, in order to secure high terminal velocity and great energy for the projectile in service against iron-clads, at long ranges. The same end is desired for field artillery, the high ratio giving a heavy projectile capable of containing a large number of bullets, which the high terminal velocity permit of small size, while still rendering them efficient at long range. It appears that the new German 3″-78 gun fires a projectile weighing 26.4 pounds, giving this ratio as 3.70, which, though considerably higher than any heretofore noted is still very much less than has become common with seacoast guns. The application of such a ratio will, by reducing the caliber to the minimum, greatly simplify the problem in hand, and enable the ready construction of the desired guns and carriages, and especially will this be facilitated by the moderate pressures which will secure the required terminal velocities.

With proper weight of material it will appear that the weights of the projectiles for the different guns will be 15.5, 21.2, and 31.4 pounds respectively, and by assuming what might be considered suitable ratios, the calibers would be indicated, but these are matters which depend upon no such assumptions, as will hereafter appear. For the present the weight of projectile is to be considered, and under the condition that the pressure in the bore of the gun shall be such as to permit of a reasonably light shrapnel shell containing a fair percentage of bullets. The *dangerous space* is measured by the "pattern" which the bullets of the exploded shrapnel will give, and depends upon the closeness of this pattern, upon the length of front it will cover perpendicular to the trajectory, and the distance from the shell burst to which the bullets will inflict a "dangerous wound," the measure of which is taken to be a penetration of 0″.63 in white pine at a distance of 100 yards.

Given a line of infantry behind a rifle-pit and assuming the area of a man's exposed head and shoulders to be two square feet the object to be secured by a properly exploded shrapnel is to distribute the bullets and fragments evenly over a circle, whose area is equal to twice as many square feet as there are bullets and fragments. If we wish to make two hits, the number of square feet of surface will be equal to the bullets, etc. The dangerous space in either of these cases is manifestly the diameter of such a circle. A shrapnel giving 880 such missiles, for a single hit

would give a pattern covering 1760 square feet, with a diameter of about 47 feet, and the dangerous space would cover about 25 files of infantry, measured along the line.

If the object be, as it must from the very nature of the case, to get at men behind cover, it requires no demonstration to prove that the dangerous space can only be increased by an increased angle of fall, most certainly not by a flat trajectory. So, in respect to this space, when firing upon troops in the open, no bullet is expected to pass through one man and wound another, and the greatest distance at which a dangerous wound is given is measured by the power of penetration of the bullet. This distance varies from about 100 yards at the extreme range, to about 500 at 1000 yards range, depending upon the velocity and size of the bullet. It is evident that the best results would be obtained if all of the bullets fell within their effective range. This end can be secured in two ways only: by a shot-burst, which, if adopted, would for most ranges destroy the value of the pattern perpendicular to the trajectory, give too close a one—or by a considerable angle of fall. This angle, even with reduced charges, is too small at the most useful ranges, and far too great a proportion of the bullets are thrown up into the air only to fall harmlessly to the ground outside of their greatest effective range. One of the conditions imposed by the Artillery Board for the construction of a gun and carriage, was that they permit of an elevation of not less than 30°. No one can suppose that such experienced artillerists as composed that Board had in view the engagement of an enemy at any such preposterous ranges as such an elevation will give with any kind of a modern gun, when 20° insures a range of about 6c00 yards. The old 3″ rifle, with 1232 f. s. and its light projectile gave anything but a flat trajectory, and the 12-pdr. one even less so. The experiences of these officers during four years of war was as comprehensive as those of officers in any army, and had thoroughly demonstrated in scores of well-contested battles the inutility of even the greatly curved trajectories at their command. They found them too flat, especially to facilitate driving an enemy from behind rifle-pits and field-works, and it was to correct this very evil that they demanded this great elevation for the gun, that by the aid of reduced charges the angle of fall might be increased to the greatest possible extent for the use of shrapnel fire. This shows conclusively in what light they held a flat *vs.* a curved trajectory.

In almost every instance, at least toward the close of the war, they found the enemy in a hole in the ground, or behind intrenchments, or cover of some kind, and the effects of shrapnel fire was a direct function of the angle of fall, and in most cases, one of 90° would have been the best possible. In fact, to such an extent was this true that, could they have secured for their projectiles the peculiar characteristic of the boomerang and take the enemy behind his defenses in reverse, an angle of fall much greater than 90° would have been the best possible. With the moderate initial velocities obtaining in European services, the reduced charge and high angle-fire is a well-recognized necessity, and when they take to "digging" to the extent practised in this country, this necessity will be greatly increased. Again, the heavy projectiles have a more uniform trajectory and greater accuracy. They also have a very much more uniform velocity, and thereby assure us the power of better regulating time-fuses; one of the most difficult matters with which we have to contend, more especially when high velocities and light projectiles are used. The great uniformity in velocity may possibly enable the use of what might be termed an *automatic time-fuse*. The mean terminal velocities for one of these guns, as that for position artillery, between 1000 and 2750 yards (between which ranges most of the fire against infantry will take place), is 1112 f. s., corresponding to a range of about 1600 yards, the difference from the extremes being only 68 f. s. If the shell-burst should take place at, say 100 yards in front of the object fired at, that distance may be taken out of the fuse composition by making the first 100 yards read 200 yards. The fuse being now set to correspond to the range, 1600 yards, burns out at 1500, and bursts at the proper distance in front of the object. And so for any other range. But it is at once observed that the fuse will burst "long" for shorter ranges than the mean, and *vice versa*. On account, however, of the uniformity of velocity secured, this degree of "long" or "short" is quite small, and so small that it is within the power of the gunner to secure a very satisfactory degree of practice without making any correction in the fuse, other than to set it to the range at which he is firing. If the "long" fuse for the shorter ranges be made to burst a little lower, he will still obtain good results as to pattern for his exploded shrapnel, and *vice versa*. All he has to do, then, like the marksman in correcting his shooting, is to take a finer sight for all ranges below the

mean, a correction which shorter ranges naturally aids, and a coarser one for those above. Like all other kinds of firing, to acquire profiency in such as this, will, of course, require practice, but in which a well-trained and intelligent gunner will readily obtain proficiency. The fuses for the long-range shrapnel can be regulated in the same way. Here the "long" or "short" will be much less than for the other fuse, as the velocity is more uniform.

A high initial velocity and pressure in the bore not only necessitates a light and small projectile, incapable from its size from containing a sufficient number of bullets for effective shrapnel fire, but further necessitates a very strong shell, and thus makes matters still worse. That for the 3″.2 gun contains 25 per cent. of its completed weight in bullets. The Germans produce a shrapnel for their horse-artillery gun which contains 37.3 per cent. of bullets, and that for their field guns contains 43 per cent. Even the Italians, whom we might not consider our superiors in mechanical skill, get the same percentage of bullets into their shrapnel shells as do the Germans. With reasonable pressure in the bore of the guns and reasonable initial velocities, we should be able to get 40, 43, and 45 per cent. of bullets into the projectile indicated. Common shell, and at least two kinds of shrapnel, are required for each gun, not only to secure greater effect of fire by increasing the number of bullets in the shell, but also in order to realize the greatest effect of high angle fire with reduced charges, which cannot be done with a single projectile without the use of bullets so large that the shrapnel will be almost worthless. The first stage of the modern battle for infantry usually commences at about 2700 yards range, within which our fire will generally be directed against that arm, and we must, therefore, have the greatest possible number of bullets for fire within this range. Every service has at least three, and many four different kinds of projectiles to secure improvement in the effects of fire as the range becomes less. For the latest gun produced, Krupp's 3″.78, all projectiles weigh exactly the same, 26.4 pounds; such should be the case for all field guns. To distinguish one kind of shrapnel from the other necessitates their being marked in some suitable manner, as "X" and "XX." Remembering that a penetration in white pine at 100 yards of 1″.2, will produce a "very dangerous," and of 0″.63, a "dangerous wound," the following table will serve to illustrate the elements of the shrapnel pro-

posed, the number and weight of bullets contained, their velocities, penetration in white pine at 100 yards from the point of shell-burst, and the extreme range from this point at which a penetration of 0″.63 is assured, based upon one of 0″.98 by a bullet of 64 to the pound, with 690 f. s. initial velocity. For a penetration of 0″.63, the initial velocities—the terminal one of the shrapnel shell — required are: bullets, 64 to the pound, 554 f. s.; 90, 694; 20, 474 f. s.

SHRAPNEL SHELL.

Kind.	Bullets.		Guns.	I. V.	1000 yards.		2750 yards.*			4500 yards.*		
	per lb.	No.			V/	Range	V/	Penet.	Range	V/	Penet.	Range
			″	f. s.	f. s.	yds.	f. s.	″	yds.	f. s.	″	yds.
X	64	307	2.74	971	866	236	781	1.23	215			
XX	20	96	2.74	971	866	420	781	1.63	373	674	1.22	302
X	90	558	3.07	1455	1157	205	900	1.27	143			
XX	64	397	3.07	1455	1157	294	900	1.66	249	751	1.16	194
X	90	819	3.45	1424	1174	206	937	1.5	156			
XX	64	576	3.45	1424	1174	298	937	1.78	258	799	1.3	219
X	90	1260	3.95	1423	1180	207	945	1.55	166			
XX	64	896	3.95	1423	1180	299	945	1.8	259	808	1.3	222

* These ranges for the mountain gun are 2000 and 3500 yards, respectively.

NUMBER OF BULLETS CARRIED BY BATTERIES.

Guns.	Old 3″ Rifle	New 3″.2.	PROPOSED.		
			3″.7.	3″.45.	3″.95.
No. rounds per gun.....	216	208	160	150	130
Weight of shrapnel, lbs...	10.5	13	15.5	21.2	31.4
Bullets per pound	21	32	64—90	64—90	64—90
Bullets in shrapnel.....	81	107	397—558	576—819	896—1260
Total bullets per battery..	84,078	106,572	397,632	524,000	582,120

An inspection of these tables reveals some of the reasons for the large increase in the artillery of an army within the past few years, in Germany from 84 to 120 guns in an army corps, while the number of muskets remains the same. A battery firing such a shrapnel as the first one for the position gun, and at the ordinary rate of one shot in four minutes per gun, will deliver in a given time within a range of 2750 yards, more bullets than a battalion of 1000 infantry firing at the rate of one shot per man every 30 seconds, and with greater accuracy at long ranges, than an individual sharpshooter can obtain within his greatly reduced range in firing at will, as the gunner fires his piece from a dead rest, and has four minutes within which to load and secure

accuracy of aim. Moreover, while the battalion would expend a supply of 180 rounds per man—when they get a modern small-bore rifle out of the ordnance department, which it is to be hoped will be sooner than the artillery can get any kind of a gun—in an hour and a half, the battery can keep up its rate of fire from this projectile alone for four hours, and still have a sufficient supply of the others in the battery to maintain the same rate, but reduced volume, of fire for nearly five hours longer. We hear very little now as to the space occupied by artillery in the line of battle and upon the march. Its range and destructive effect against inanimate objects, and its power and volume of fire against animate ones, now entitle it to all the room it wants, and it is generally freely conceded. If not, those who deny it suffer.

Velocities.—When speaking of "high velocities" for field artillery, many consider only such to be so as are equal, or nearly so, to those obtaining with seacoast or other heavy guns. For many and obvious reasons the velocities for such guns have, and can have no comparable relations to those for field artillery. With the exception of one English gun, which is by no means the best in Europe, no field gun in any service has a higher initial velocity than 1608 f.s., which is that for the French horse-artillery gun. Only two others, the German horse gun 1525 f.s. and the Spanish field 1552 f.s., have a greater velocity than 1493 f.s. That for the old 3″ rifle was 1232 f.s.. and even less for most of the old guns in every service, from which it appears that for field artillery any velocity over 1400 f.s., is a high one, very high when over 1500 f.s. and excessive when over 1600 f.s. With 1750 f.s., the terminal velocity at 4500 yards for the 3″.2 light field gun, is 675 f.s. With 1456 f.s. this terminal velocity for the corresponding German field gun is 722 f. s. The energy of the projectile for the former is 41.2 f.t. and for the latter 64.7. Evidently the mere fact that the initial velocity is even an excessively high one does not of necessity amount to anything, except that in field artillery it is almost certain to prove a very poor gun.

This 3″.2 light field gun and its carriage is only 68 pounds less in weight than for the above 3″.46 heavy field gun. Our excessive velocity and light projectile punishes us to the utmost extent, but lets the enemy off with the slightest possible damage. At a single blow they destroy the efficiency of fire, and ruin the mobility of the carriage, the two qualities above all others which go to make an efficient field artillery.

POWERS OF LIGHT FIELD GUNS.

At the muzzle.					At 4500 yards.			
Nation.	Cal.	Proj.	I. V.	Muzzle Energy	Nation.	Bullets	v_f	Mv^2
			f. s.	f. t.				
U. S.....	3".2	13	1750	276.4	Germany.....	210	722	64.7
France.....	3.54	18.04	1493	276.3	France.....	192	702	61.6
Germany.....	3.46	17.93	1456	264	England.....	128	638	50
Spain.....	3.43	15.62	1552	260	Spain.....	177	660	47.3
Austria.....	3.43	15.74	1471	236	Austria.....	165	649	46
England.....	3.6	17.9	1355	228	Italy.....	177	652	43.5
Italy.....	3.43	14.74	1489	227	Russia.....	165	636	42.6
Russia.....	3.43	15.35	1450	224	U. S.....	107	675	41.2

Telescopic Sight and Range Finder.—The extreme ranges readily practicable for field guns, when proper ballistic conditions are adhered to, will be found of little value unless the guns are provided with good telescopic sights. There appears to be no good reason why the simple principles applied with target rifles should not be adapted to field guns. The instrument should comprise in general an ordinary telescope, object-glass and eye-piece, achromatic and of perfect workmanship and material, firmly secured in a metal tube, from half to three-quarters of an inch in diameter, the object-glass being from three-fourths to one inch in diameter, the eye- and object-glasses being provided with the ordinary focusing adjustments. The axis of the telescope or line of sight is marked by cross-hairs, or perhaps better, by lines upon a glass, firmly secured and adjusted by the maker as near the axis of the tube as possible. The power of the telescope should be about 15. For rifles, such telescopes are made up to 46 inches in length, for artillery purposes with field guns, not more than 34 inches length will be required for the largest gun.

The telescopic tube is hinged at the object end in any suitable manner to a convenient point upon the gun, as at a point over the left trunnion, or in rear of it, the eye end rests upon a suitable form of slide-bar upon the usual breech-sight of the guns as the Phipps-Quinan sight. The top of the telescopic tube is provided with ordinary open rifle-sights, to aid in giving direction, or for pointing at short ranges and when rapid firing is necessary. For the ordinary sights, a steel pin fits into the front socket with a notch cut in the bottom of the rest on the slide-bar for a rear sight. With heavy guns, if the tube must become too long, a bar

takes its place, provided with a pair of Y^s, upon which the telescope is mounted.

The sight is adjusted to the piece so that the line of sight when the origins of the breech sight are at 0, may be parallel to the axis of the piece. To mark the axis of the piece requires a pair of "*adjustment rings*," one to fit the breech with a peep-hole bored in the center; the second to fit the muzzle, is provided with a pair of cross-wires, one end of each adjustable if necessary; these wires may be adjusted by placing the rings in position, and by them sighting upon a small, distant, but well-defined object, with one of the wires horizontal; revolve the front ring 180°, and if the wire does not still cover the object, correct one half the error by means of the adjustment-screws in the ring, and the other half by means of the elevating screw of the piece, and repeat if necessary. The other wire is then turned to the horizontal and adjusted in the same manner. The breech-sight—ungraduated—and the telescope are then placed in position and the line of sight brought to bear upon the same object, when the axis of the bore and the line of sight will be sensibly parallel. The origins of the elevating arc and of the deviating bar are then marked, and the sights graduated in *yards*. When the bar is used, to facilitate adjustment, one of the Y^s may be made adjustable.

Range-finding.—Estimate the distance to the target or object, give an elevation insuring generally a "short" hit, aim the piece at the object and fire, with a common shell if the distance be great. Note the point struck by the projectile, and, without having changed the sights, reaim at the object; then, without changing the position of the piece, bring the line of sight of the telescope to bear upon the point struck by the projectile and clamp. The sight will now indicate both the range and the necessary correction for deviation; subject, of course, to the error of fire in the gun, the "personal error" of the gunner, and a further exceedingly small one due to the fact that equal parts of the elevating arc do not measure equal ranges, but this error is inconsiderable, even at extremes, and still less in this practice, as the arcs actually used are those immediately adjacent to the point at which the sight is set. To find ranges with two or more guns in the same battery, estimate the distance as before, and set all of the sights alike and aim all at the same object. Fire one; the gunners of the other pieces note the point where the shot struck, and, without changing the position of their pieces, bring the lines

of sight of their telescopes to bear upon the point hit and clamp; they now have both range and deviation. To insure greater accuracy, the pieces not fired may be reaimed and a second gun fired, the remaining gunners proceeding as before. This may be done either over land or water, whenever the point struck by the projectile can be seen, and to insure this in field artillery, common shell are fired, the smoke of which upon bursting can be seen at the longest ranges.

Observations.—One of the most important functions of the telescope is to enable the gunner to determine the point where his shots strike, as without this knowledge it is impossible for him to do execution. He must be his own "marker," as the enemy will not do it for him. The piece having been aimed, the gunner removes the telescope with one hand and the breech-sight with the other, returning the latter to its pouch. He then makes use of the telescope for purposes of observation, and if a "rest" is required with no convenient one at hand, he can secure an excellent one by setting down and holding the instrument as does the soldier his rifle when firing from this position. From the length and small size of the object-glass for such a telescope, the field of view will be restricted. But with a power of even 20 for ordinary field guns, the field of view at 1000 yards can be made equal to 100 yards, or equal to the front of a battery; such a field will cover any possible error in fire, and will prove ample for all practical purposes. With the bar any reasonable field of view can be secured. Too great power in the telescope is not desirable, but the material and workmanship must be the best obtainable, at any cost; a good instrument is of as much value as the gun itself. In fact, for long range-fire, the gun has little value without a good telescopic sight.

Carriages.—The weight of the carriage should be proportioned to that of the piece. If too heavy, the shock of the piece is very destructive. Too heavy a piece upon a light carriage will perform better service than the reverse conditions, since the effort of the piece is a function of its mass into the square of its velocity. The weight of the carriage should properly be less than that of the piece, or as near thereto as possible. The weight of the wheels must also be proportioned to that of the carriage; if too great they impose too great a strain upon the axle. The strain upon the carriage being represented by the expression:

$S = P. \frac{\pi d^2}{4} (1 - \frac{W.G.}{W.G.C.})$, in which:

P=pressure per sq. in. on bottom of bore.
D.—Caliber.
W. G.—Weight of gun.
W. G. C.—Weight of gun and carriage.

It is evident that the caliber and pressure must be the least possible, to insure a reasonable weight of carriage, while the weight of the gun must be the greatest possible. Also for any given weight of gun and carriage, the strain which the carriage is capable of withstanding having been substituted in this formula, the caliber becomes a function of the pressure. A pressure having been decided upon determines the proper caliber for the gun at once.

The proper weight of a field gun is not determined by the least weight of metal which will give sufficient strength, any more than is the pressure in the bore taken at the maximum which the gun will stand after completed. The 3″.2 gun is 190 pounds lighter than the corresponding German gun, but its carriage is 140 pounds heavier, its projectile is 5 pounds less, and although it is fired with greatly increased pressure, and 17 per cent. more initial velocity, the energy of its projectile is 50 per cent. less than for the foreign gun at useful battle ranges. The form, size, etc., of the carriage are restricted within certain, and very narrow limits, and the weight of the gun, its caliber, and the pressure permissible, must be determined in connection therewith by established mechanical laws which have been found to give the best results in practice. The first limitation is of course that as to mobility, being 3120, 3684 and 4457 pounds respectively for the different gun-carriages complete. Of these weights according to the old proportions for our service, and of the best existing guns, as modified by the conditions respecting ammunition, seats, brakes, etc., about 45.6, 43.2 and 39 per cent. respectively should be assigned as the weights of the limbers packed for service, leaving, as the weights for the guns and carriages 1696, 2116, and 2716 pounds respectively. When a uniform track is maintained for all of the carriages, it is found to be impossible to secure a carriage for horse artillery which will be less in weight than the gun. The old 6-pdr. carriage was 1.07, the 3″ rifle 1.12 and the new Spanish carriage 1.31 times the weight of the gun, the latter due to the fact that the gun is a

very light one, even worse than the 3″.2. The general practice for this kind of gun has been to confine the weight of the carriage within 1.2 times that of the gun. A ratio of 1.15 in the present case will give 787 pounds as the proper weight for a horse artillery gun, and 909 as that for the carriage. As will hereafter appear, the carriage body for the old 3″ rifle weighed 540 pounds, with lock-chain, rings, hooks, etc., which are not required upon a new one. The above weight with suitable wheels will allow 592 for a steel carriage with brake, and it ought to be much stronger than the old one even without the aid of better material. The maximum pressure in the bore of the old 3″ rifle was 50,000 pounds, and with a mean pressure of 45,000 the strain upon the carriage was 78 tons; in other words this old wooden carriage body of 540 pounds withstood a greater strain than does that for the 3″.2 gun with 34,000 pounds pressure, and which weighs 819 pounds. Evidently no care has been taken to make the conditions favorable for the new carriage.

For field artillery the Germans make use of pressures from about 2100 to 2200 atmospheres, and the latter, 32,480 pounds will be the maximum required for a gun of this kind, and more than 25 per cent. less than for the 3″ rifle. To insure practicable strength for a carriage of the weight indicated, but more especially to restrict the recoil of so light an element within reasonable limits, the strain to which the carriage is to be subjected may also be reduced 25 per cent., when there can be no possibility of doubt as to a sufficiency of strength. We shall then have:

$$\text{Strain} = 14.5 \frac{\pi d^2}{4} \left(1 - \frac{787}{1696}\right) = 57.4 \text{ tons, whence } d = 3.07 = \text{caliber of the gun,}$$

and so long as the proper conditions are adhered to the carriage, light as it apparently is, will not be overstrained, neither will the recoil be excessive, while the margin of safety for the strength of the carriage will permit of the use of the road-brake to still further reduce the recoil. In like manner the weights of the other guns may be determined, the ratios being 0.945 and 0.741 respectively for the field and position guns, those for the old 12-pdrs. light, and heavy being 0.95 and 0.68 respectively. When a proper weight of gun is adhered to there is no necessity for increasing the weight of the carriage determined for a horse artillery gun, when used for the other guns, except the increase of

weight incident to different shape for larger guns, seats, wheels with greater tread, etc. Thus the three gun-carriages for the German 3″.09, 3″.46, and 3″.78 guns weigh 1098, 1098 and 1153 pounds respectively, allowing 62 pounds as the weight of the seats for the 3″.46 guns. No additional strength of wheel is required for purposes of transportation, as the shock and strain incident to firing the gun is many times as great as any other to which the wheel can ever be subjected, and but little additional strength is required, as the strain for the heavier guns are but little greater than for the light one, while the increased relative weights of the guns makes the conditions more favorable for the wheels and carriage. A greater tread is however required to facilitate transportation, and with this naturally and properly go somewhat greater weight and strength.

When the well-established mechanical laws are heeded, there is no need for our going out of our way in order to save weight by the use of light guns mounted on some form of light non-rigid carriage, or one provided with some kind of device to take up the recoil. The Russian or Engelhardt carriages are supposed to be marvels of lightness. When measured by the amount of useful ballistic work performed Krupp's carriages are the lighter, and this fact is not confined to the carriage alone but to the gun and carriage combined. By going back to the table for the Mv^2 for the projectiles this fact is made very apparent.

	Pounds of Gun and Carriage to fire one pound of Projectile.								Pounds of Carriage to fire one pound of Projectile.							
Kind.	Mountain		Horse.		Field.		Position.		Mountain		Horse.		Field.		Position.	
Nation.	Cal.	lbs.	Cal.	lbs.	Cal.	lbs.	Cal.	lbs.	Cal.	lbs.	Cal.	lbs.	Cal.	lbs.	Cal.	lbs.
	"		"		"		"		"		"		"		"	
Proposed...	2.74	44	3.07	109	3.45	96	3.95	85	2.74	26	3.07	58	3.45	48	3.95	37
Russia.....	2.5	51	3.43	117	3.43	137	4.19	95	2.5	38	3.43	65	3.43	72	4.19	46
Germany...	2.95	62	3.09	162	3.46	121	3.78	96	2.95	26	3.09	91	3.46	66	3.78	43
England...	2.5	124	3.0	138	3.6	140		126	2.5	71	3	100	3.6	84	4	67
France.....	3.15	40	3.15	167	3.54	148	3.7	133	3.15	30	3.13	93	3.54	83	3.7	64
Austria	2.6		2.93	160	3.43	145			2.6		2.93	98	3 43	77		
Italy.....	2.95		2.95	146	3.43	107			2 95		2.95	94	3.43	95		
U. S.....	1.65	161	3.0	175	3.2	161			1.65	107	3.0	96	3.2	100		

In proportion to the results accomplished, the German field and position gun-carriages are both lighter than the Russian ones. But we are under no necessity for seeking foreign illustrations to demonstrate the value of adhering to the established principle in

order to secure excellent results. Our own service furnishes an excellent example in the change from the old 6-pdr., to the 3″ rifle. Although the constructor had not the advantages of modern powder in his favor, and had to face the difficulty of an enormously increased pressure, he did not change the weight of the old carriage at all, increased the weight of the projectile 50 per cent., and the weight of metal in the limber 20 per cent. and at the same time secured a less weight behind the team than that for the old gun. To secure these satisfactory results, remarkable as compared with those of the present day, it is hardly necessary to point out the fact that he did not overstrain the carriage which he found to his hand. Strengthen the axle he did, but this involved in his practices no increased weight. He accepted the evil of excessive pressure because he could not do otherwise, and then proportioned his caliber to the weight and strength of his material. The recoil of the new gun was very great as compared with that of the old one, but in view of the greatly increased powers of fire, the artilleryman had little to complain of.

For the calibers of the other guns heretofore indicated, after making suitable reduction to prevent too great recoil, we shall have for the field gun:

$$S=14\frac{\pi d^2}{4}\left(1-\frac{1088}{2116}\right)=63.6 \text{ tons, } d=3.45=\text{caliber, and for the position gun:}$$

$$S=14\frac{\pi d^2}{4}\left(1-\frac{1560}{2716}\right)=74.26 \text{ tons, } d=3.95=\text{caliber.}$$

The problem now is not in the construction of guns of these caliber which shall be of the least weight capable of sustaining the strains imposed by the pressures, for the weights of the gun, already determined by other principles, far exceeds what is necessary for mere strength. The problem is simply to properly arrange the weights determined around a suitable length and volume of bore and chamber which, with the proper kind of modern powder, will give at battle-ranges the desired terminal velocities. A further limitation being that the length of bore must be the least possible, both to facilitate the handling of the pieces and to limit the recoil.

It is rather a curious fact that the German 3″.46 gun with an

18-pound projectile, though a lighter gun than the 3″.2 gun, still has a lighter carriage than that for our gun.

COMPARATIVE WEIGHTS OF GUNS IN TERMS OF ROUND SHOT.

United States.						Proposed.		
6-pdr.	Light 12-pdr.	Heavy 12-pdr.	3″ Rifle.	3″.2.	1883 3″.2.	3″.07.	3″.45.	3″.95.
138.3	102.2	146.4	231.8	188.4	166.5	205	200	196

Spain.	Russia.		Germany.		France.		
5″.09.	3″.43.	4″.19.	3″.46.	3″.78.	3″.15.	3″.54.	3″.7.
159.5	151.3	139.5	177.7	191	228	200	234

The French guns are of such weight that their carriages ought to present the best showing of any in Europe. Excessive initial velocities and pressures in the bore ruined their opportunity, and, as has already been seen, without any compensating advantages, the German guns remaining the most powerful except at the muzzle, where the enemy is not found.

Our 3″.2 gun was planned for a light, or, according to the nomenclature here used, a field-gun, provided with the usual seats, etc. First we had an old 3″ rifle converted, with calibers of 3″.16—17—18—and then 3″.2. An inspection of the calibers of foreign guns reveals nothing like this. Horse-artillery guns range from 2″.95 to 3″.15, excepting in the case of the Russian, which no one cares to reproduce, and field-guns range in caliber from 3″.43 to 3″54—the English 3″.6 gun was originally a position gun. While our gun approximates the horse-artillery gun in caliber, weight of projectile and power, it on the other hand makes use of the field artillery measure of mobility, and we, in fact, simply have a "cross" between the two, and, as is generally the case, the hybrid inherits all of the vices of the parent stock, without any of the compensating virtues. The origin of our trouble was in starting with the old 3″ rifle under the supposition that it was a light field-gun, the place of which the new one was to take in our system. It was a horse artillery gun, and was never intended for anything else, though the force of circumstances and the want of any gun to take the place of the old, light 12, caused it to be used, and finally regarded as a light field-gun proper. Had the old ordnance constructors planned a

gun to take the place of the light 12, upon the same lines as those of the 3″ rifle, the new gun would have weighed about 1200 pounds, caliber 3″.44, with a projectile of about 15 pounds. This is the gun the place of which our present one should have been planned to take. Had it been in service, it is safe to say that we should never have heard of such a preposterous caliber as 3″.2 for a field-gun. Aside from the question of mobility, it may be conceded that the 3″.2 gun is an improvement upon the old 3″ rifle, but had the old ordnance constructors made a gun to take the place of the light 12, and succeeded as well as they did in the cases of the 3″ and 4″.5 rifle, this new gun would be no improvement upon their work.

Wheels.—As it is highly desirable to have the wheels of a battery alike, if this condition is to obtain, it is an absolute necessity that the weight of the wheel shall be the least possible, otherwise any excess of weight would be multiplied from eight to ten times or more for each gun. If it is an absolute necessity to have a heavy wheel for the gun-carriages, then we must go back to the old practice and make use of only such weight for the limbers and caissons as will serve for purposes of transportation. Since the advent of shrapnel-fire this has become a much less serious matter than heretofore, as the actual damage to material is now very small. A well-exploded shrapnel might possibly disable every man and horse at a piece, without doing any serious damage to the carriage, and there is now scarcely a possibility that a limber or caisson wheel will ever be required to replace a disabled one for a piece. Like many another custom of the past, which was necessary and proper in its day, this one of the interchangeability of all of the wheels of a battery has been perpetuated long after the conditions which first established it have vanished. Of course, all of the limber and caisson wheels would still preserve this feature, as would the gun-carriage wheels of any particular battery, and in the horse and field batteries all of the wheels would probably best be alike in each. But because the position gun-carriage may require a 200-pound wheel, it would in these days be sheer idiocy to inflict the same wheel upon the caisson teams. The question may properly be raised whether it would not be a wise measure to reduce the diameter of the wheel for horse-artillery. Such a step would result in a very appreciable gain in strength and weight, and would seem to be demanded from the fact that the horses required for such

service are much smaller and lighter in weight than those required for the other batteries. Of course, they must be compact and strong animals, but to secure the celerity of movement indispensable to these batteries, they must of necessity be smaller than for the others. Any reduction in the diameter of the wheel will also result in another most important benefit, especially for such light guns and carriages, in the tendency to reduce the recoil. The unquestioned excellence of the Archibald wheel is fully admitted, and its substitution for the old one, for the same service, ought, undoubtedly, to result in a reduction of weight, and, as will hereafter appear, the strains to which the old wheels were subjected in any particular battery, were quite as destructive as will now be the case in similar modern ones. The Russian wheel, similar in character, but certainly no better, for their field and position guns, weighs only 151 pounds, though it is only two inches less in diameter than our own. Its use with their position-gun demonstrates its ability to carry great weight in transportation, a fact, by the way, of which we already have perfect knowledge—and its use with their field-gun, to sustain the shock due to rapid movements, even with as great a load as is here proposed. All of these things we know perfectly well without going to Europe for facts. So far as transportation is concerned, the lightest wheel of the old pattern would suffice, and no field service short of throwing the carriage over a precipice would result in serious damage. There will be no necessity for having different wheels for the gun-carriages for the horse and field batteries and possibly not for those of position, as this carriage fulfills the required conditions for resisting the strain far more perfectly than any of the others. On account of the increase of the permanent load of the caissons, the tread of their wheels should be greater than for the old ones.

The Archibald Wheel Company, of Lawrence, Mass., claims that, weight for weight, and of equal diameter, their wheels are from 25 per cent. to 50 per cent. stronger than those of the old pattern, depending upon the character of the service required. The old ones, with a tread of 2.75 inches, weighed 180 and 196 pounds respectively, and the latter, with the old, light 12-pdr., with a pressure of only 22,400 pounds in the bore, had to resist a strain upon the carriage of over 83 tons. A reduction of 25 per cent. will give a stronger and better wheel, weighing only 147 pounds, while that here proposed, subjected to a strain of

only 60 tons, and with a tread of 2.5 inches, is fixed at 148 pounds in weight, while the others with treads of 2.75 and 3.25 inches are taken at 160 and 180 pounds respectively. These weights are greater than necessary, but it is a question whether the tread should not be further increased. Telford's rule called for 1-2 inch of tire for every 500 pounds of load upon a wheel, including the weight of the carriage.

Modern authorities give for carriages without springs:

1-2 to 3-4 ton on each wheel 3-inch tire.
3-5 " 1 " " " " 4 " "
1 " 1 1-2 " " " " 6 " "

These widths of tire are for use upon good roads, and for economical services, both as to traction and wear and tear upon the road. Poor roads, or none at all—too frequent conditions of field artillery service—call for even greater width of tire.

Limbers and caissons.—Those specified in the Report of the Chief of Ordnance, 1885, are entirely inadmissible. The horse-power remaining the same, the maximum loads cannot be increased above what has heretofore been carried, and as the old material has proved thoroughly efficient in this respect, of course there is no necessity for any increase of weight. In fact, the weight to be carried by all of the limbers is less than for the old 3″ rifle, and there ought to be a reduction in the weight of the limber bodies, and this aside from any reduction that ought to be due to better forms, material, and workmanship. To suppose that the wagon-makers of this country cannot improve upon this old material, giving carriages of greater strength and lighter withal, is absurd. We have the proof that they can do so before our eyes every day of our lives. The following table will serve to illustrate the value of the material. The caisson body complete weighs 1632 pounds, the limber, with the lightest chest of the lot, 1097 pounds; gun and carriage, 2100; paulin, 54 pounds.

	Gun Carriages.		Caissons.	
	H. A.	F. A.	H. A.	F. A.
Limiting Loads	3.120	3.672	3.972	4.230
3″.2 Gun	3.251	3.672	3.972	4.230
Number of rounds	0	25	70	85
Number of caissons			8	9
Number of rounds per gun	93	154		

A return to the old wooden chest is to be made, with which

the above showing would be slightly improved. The caliber and weight of the projectile for this gun classes it with horse-artillery. For the German, the projectile is 12.16; French, 12.54; Spanish, 13.89, and Russian, 15.35 pounds respectively. To secure the degree of mobility in a horse-battery called for by the horse-power, requires that the number of rounds per gun be reduced to 93, and without a single one in the limber of the piece, this carriage will still be 131 pounds too heavy. In other words the gun and its carriage with an empty limber weigh more than they ought with 30 rounds in the limber. As a field gun the number of rounds carried is practically the same as the battery should carry with a projectile weighing 22 pounds. Of course the 200-pound wheels have a great deal to do with this showing. The fact is that the weight of the material, great as it is in excess of what it should be, is not entirely the cause. A large share of this is to be charged to the *number of spare wheels* and the getting rid of some of these constitutes the secret of the favorable showing to follow, in the ability of a battery to carry the usual number of such exceptionally heavy rounds, and not in any assumed excellence of the material. Upon the advisability of getting rid of some of the preposterous supply of spare wheels which will result if one be retained for each caisson necessary, depends much of the success of a modern system, in so far as respects the transportation of the requisite amount of ammunition. The question then is, *with how many spare wheels ought a battery to be provided?* It appears upon its face that from 8 to 12 per battery is an excessive supply. Data respecting this question was collected relating to the Franco-Prussian war, but it cannot now be found. From recollection it is believed that the wheels disabled in battle in the German batteries, did not average one per battery for their entire active army for the whole war. The proper supply should of course be restricted to the requirements of a single campaign. This apparent remarkable showing is no doubt due to the change in the nature of modern fire, now confined almost exclusively to shrapnel, and which of course has little or no destructive effect upon the material. It is also believed from information received from the older artillery officers, that if data respecting such damage in our batteries during the late war be compiled, it will be found that the loss did not exceed, on an average, one wheel per battery in any campaign. Of course it is not proposed that all wheels wantonly thrown away to get rid of

the useless weight are to be counted as damaged or disabled. It is an exceedingly rare occurrence that a wheel is disabled otherwise than in battle, and the chances that disability will take place in the future, from the effects of shrapnel fire, are reduced to almost *nil*, while the use of common shell against the guns of a battery is so restricted that but little danger is to be apprehended from this source. Use for the latter is found in the necessity for the destruction of buildings when the artillery material is not in danger; for the destruction of rifle, and gun-pits, and in general field-works of all kinds, where such material has secured reasonably good cover and protection. Moreover, when we have created the conditions under which we may expect the maximum of common shell fire to be used against us—a defensive position, we have the trains all at hand and properly disposed, and it would be a very simple matter to make temporary provision for any anticipated increase in the destruction of material, rather than make a permanent one which may seldom or never be called upon, but which will ever reduce the efficiency of the battery under all circumstances. It is only necessary to carry a sufficient supply of spare wheels—or any other material for that matter, for a single campaign, and it is held that the positive experiences of service under the modified conditions of modern warfare, will justify the removal of all but one in a battery, or, in case it be found advisable to have the gun-carriage wheels heavier than for the limbers and caissons: of one spare wheel for the gun-carriages, and one for the other carriages. This will prove an ample supply when the batteries are serving together in numbers, as in the divisional and corps artillery of a modern army organization; when, if any battery meets with exceptional damage, it has plenty of more fortunate neighbors near at hand to help it out of difficulty. Exceptional cases for a small number of batteries, or a single one upon particular service, might possibly require more, when they can be readily provided. Thus far the question has been considered without particular reference to any visible supply other than that furnished by the battery itself, or by its neighbors in case of extraordinary trouble. But an inspection of p. 668 of the Report of the Chief of Ordnance, 1885, will quiet the fears of any who may apprehend being found short of spare wheels in a tight place. Like the poor, the ammunition train "will always be with us," and easy of access at any time. To secure the usual supply of ammunition of the character here pro-

posed for a campaign, will require for each horse 3, and for field and position batteries 4 ammunition wagons, or 76 in all—with the usual supply of spare gun-carriages, limber, battery-wagons, forges, etc., which of course are packed for service—for a nominal organization of 16 batteries for an army corps. It will be seen that each of these wagons is to be provided with 2 spare wheels, a total of 152 for the corps, and when any battery commander sees this endless procession of spare wheels over half a mile in length file before his vision, doubtless any apprehensions he may have entertained as to the sufficiency of the supply will vanish. In fact if these wagons were provided with only one such wheel each, and even some of these be for the wagons themselves, it would seem that the supply for a single army corps ought to last a whole army for a generation. When a wheel of the old pattern was seriously damaged, it was a matter of some time, requiring a skilled workman, to repair it. With the Archibald wheel this is quite different, and instead of throwing a damaged wheel away and replacing it with a spare one as was generally the old practice, it will now be made as good as ever in a few minutes, and without requiring any special degree of skill to do so. For these reasons as well as many others, not necessary to cite, a single extra wheel now really signifies a great deal more than is conveyed by the mere number, as compared with past conditions. Until reliable and sufficient data respecting this most important subject has determined that the number of wheels to be retained should be greater, it will here be assumed at 2 per battery. The change in the character of fire, now confined almost exclusively to shrapnel, would of itself appear sufficient grounds upon which to make this change.

The limber.—Upon the success attained in its construction depends very much the power of the gun, for after it is completed and packed for service, its weight taken from the limit of our horse-power gives the weight of the gun and carriage with which to work. When the material for our *ante bellum* system was perfected, the limber received special consideration and treatment, and the results of our long war proved conclusively that it was a good one, and had the carriages been provided with suitable brakes, no other limber then, or now in existence will prove its equal. It was planned and constructed to get rid of most of the evils complained of in foreign limbers, and which have been brought back to us by the limber for the

3″.2 gun. With or without a brake the old limber is better than foreign ones, or than this new one; with a good brake it is all that can be desired. One of its best features is in the fact that it is light, and with better material and workmanship, can be made much lighter without loss of strength. The old limbers were all alike, as to strength, etc., and up to the conditions of service with the old position gun, when with a disabled piece and carriage the load would have been 2990 pounds in addition to 505 of ammunition. This is too much an excess of strength to permit of such practices now, and in order to secure the utmost of power for the horse and field guns, special limbers must be constructed for each, and limited to actual requirements in each case.

WEIGHT OF PIECES AND CAISSONS EQUIPPED FOR SERVICE.

Kind.	M. A.		H. A.		F. A.		P. A.	
Caliber	2″.74	12 pdr 4″.62	3″.07	6 pdr 3″.67	3″.45	12 pdr 4″.62	3″.95	12 pdr 4″.62
Projectile	12	12	15.5		21.2		31.4	
Charge (service)	1.2		3.1		4.		6.	
d^2/w	0.625		0.608		0 561		0.500	
Initial Velocity	971		1455		1424		1423	
Pieces	214	214	787	884	1088	1227	1560	1757
Carriage—body	164	157	537	520	567	686	688	723
Brake (lock, chain, rings, etc.)	18		55	40	60	50	80	60
Two seats					60			
Two wheels	126	120	296	360	320	392	360	392
Impl., prolonge, etc	4	10	21	58	21	58	28	58
Limber—body	.....	.....	298	335	315	335	335	335
Two wheels	.....	.....	296	360	320	360	360	360
Limber chest	.....	.....	174	185	172	182	182	182
Am'nition, packed, with spare reduced chgs.	.....	.....	574	381	679	490	774	505
Impl., equip., water buckets, etc	.....	.....	28	28	28	31	31	31
Paulin	.....	.....	54	54	54	54	54	54
Total weight	526	501	3120	3185	3684	3865	4452	4457
Load per horse	248 314	264 284	520	531	614	644	742	743
No. rounds in each Limber	.....	.....	30	50	26	32	20	32
Caissons.			8	6	9	12	12	12
Body, { with spare wheels	.....	.....	415		440		440	
Body, { without spare wheels	.....	.....	367	432	380	432	380	432
Two wheels	.....	.....	296	360	320	360	360	360
Chest (two with old caisson)	.....	.....	260	370	270	364	275	364
Ammunition, packed, { with spare wheel	.....	.....	1140		1351		1140	
Ammunition, packed, { without spare wheel	.....	.....	1330	762	1561	980	1368	1010
Impl. and spare parts, { with spare wheel	.....	.....	211		230		257	
Impl. and spare parts, { without spare wheel	.....	.....	69	196	80	223	90	223
Limber, packed (same as for piece)	.....	.....	1424	1343	1556	1452	1736	1467
Total weight, { with spare wheel	.....	.....						
Total weight, { without spare wheel	.....	.....	3719	3493	4172	3811	4209	3856
Load per horse	.....	.....	620	582	695	635	702	643
No. rounds in body, { with spare wheel	.....	.....	57		51		30	
No. rounds in body, { without spare wheel	.....	.....	67	180	59	96	36	96
Total No. rounds per gun			160	200	150	224	130	224

That these weights have been well-proportioned has already been pointed out. This must necessarily be so, as they have been made to conform with those conditions found to be practicable and most satisfactory in our own as well as in other services. With the limbers and caissons for horse-artillery, the foot-boards, etc., have been discarded as not necessary to secure lighter weights. With all of these modern material and workmanship will, beyond question, secure a still further reduction than has been indicated without any reduction in the requisite degree of strength. American mechanics and wagon-makers can safely be relied upon here.

COMPARATIVE WEIGHTS WITH THREE OF THE BEST MODERN GUNS.

Kind.	Mountain.		Horse.		Hybrid.	Field.		Position.	
Nation.	Prop.	Fr.	Prop.	Spain	U. S.	Prop.	Ger.	Prop.	Ger.
Caliber	2".74	3".15	3".07	3".09	3".2	3".45	3".46	3".95	3".78
Projectile	12	12.54	15.5	13.89	13	23.2	17.93	31.4	26.4
d^2/w	0.625	0.791	0.608	0.687	0.787	0.561	0.612	0.500	0.541
Initial Velocity	971	936	1455	1476	1750	1424	1456	1423	1470
Remaining Velocity. 4,500'			751	715	675	799	722	808	
Mv^2 " "			60.7	48.2	41.1	94	64.7	141.	
No. bullets in shrapnel	307		558			819		1260	
	96		397	142	107	576	210	896	300
Diameter Pattern, yards				7.9	6.7	20	9		
Length " "	213		194			219		222	
	420		294	260	231	298	262	229	
Pieces	214	231	787	659	800	1088	990	1560	1375
Carriage—body	164		537	546	785	567	636	688	659
Brake	18		55	55	34	60	72	80	80
Two seats					60	60	60		
Two wheels	126		296	280	400	320	384	360	384
Impl., prolonge, etc	4		21	21	21	21	26	28	30
Gun, Totals	526		1696	1363	2100	2116	2168	2716	2528
Limber, packed			1424	1497	1674	1536	2100	1736	1990
Carriages, Totals			3120	3060	3774	3684	4268	4452	4518
Rounds			30	32	30	26	34	20	22

The carriage originally constructed for the German 3".46 gun weighed 1072 pounds, and was subjected to a strain of 71 tons. But when the weight of the projectile was increased from 15.4 to 17.93 pounds, with the same initial velocity as for the lighter one, as it was impracticable to increase the weight of the gun, or provide new ones on account of the expense, the weight of the carriage had to be increased 106 pounds. Had it been possible to have put this weight into the gun instead, the original carriage would still have proved sufficiently strong.

When the Ordnance Department first took up the subject of metal carriages, 1080 pounds was deemed the proper weight of such a carriage for a light field-gun. Accepting the present weight of 2100 pounds for the 3″.2 gun and carriage to be correct, with such a carriage as the above there would have been left 1020 pounds as the weight of the gun. Such a carriage, even if made of iron, could be relied upon to be as strong as the old wooden one for the 3″ rifle, which weighed only 978 with all of its implements, etc.

Accepting also the pressure in the bore for the 3″.2 gun, 34,000 pounds per square inch we should have, taking the strain upon the old wooden carriage as the maximum for the new:

$$S = 15{,}178.\ \frac{\pi d^2}{4}.\ \left(1 - \frac{1020}{2100}\right) = 74 \text{ tons, and } d = 3.46 = \text{caliber.}$$

This would have secured for our service a better gun than the Germans or anybody else has to-day. Unfortunately, instead of adhering to a proper weight of carriage, and making the conditions as to weight of gun and caliber suitable, the reverse practices were adhered to, and naturally the consequences are the worst possible.

The Spanish carriage appears remarkably light, weighing only 904 pounds, but this combination is very nearly as bad as that for the 3″.2 gun, the gun being excessively light for its caliber, and this carriage could only be secured by reason of the small wheels and narrow track.

STRAINS ON THE CARRIAGES WITHOUT SEATS.

		Pressure, pounds.	Strain, tons.	Pounds of Carriage—body, per ton of strain	Pounds of gun & carriage, p'r ton of strain
H. A.	Old 6-pdr.....	30,000	73.68	7.3	24.9
	Spain, 3″.09.....	32,000	63.426	9.6	24.0
	Proposed 3″.09.....	31,480	57.388	10.3	29.4
F. A.	U. S. 3″.2.....	36,960	82.000	9.9	24.9
	" "	34,000	75.565	10.8	27.0
	Orig. Ger. 3″.46.....	32,480	70.742	8.5	28.3
	Imp " 3″.46.....	32,480	74.592	9.6	28.2
	U. S. 3″ Rifle.....	45,000	78.016	7.0	22.9
	Old 12-pdr.....	22,400	83.838	8.7	28.7
	Proposed 3″.45.....	31,360	63.617	9.8	32.3
P. A.	Old 12-pdr., heavy..	30,000	94.30	8.3	31.7
	German 3″.78.....	30,845	70.756	10.4	35.7
	Proposed 3″.95.....	30,000	74.256	10.34	36.5

The weights for the old carriages show how light they can

be when left free to recoil, for, under this condition, the old "brutal powders" mean greater strains to the carriage, even when the measure remains the same. The true way to control the recoil is by limiting both the pressure and caliber. With the old 3″ rifle the pressure had to be greatly increased, while the weight of the gun had to be reduced below that of the old 6-pdr., but by determining a suitable caliber, exactly the same weight of carriage was used as for the older gun.

An inspection of this table reveals the supreme importance of adhering as closely as possible to the rule that the weight of the carriage must be properly proportioned to that of the piece. It must be less than that of the piece, or as near thereto as is possible. The value of this rule is best illustrated by the old 12-pdr. gun. On account of the large diameter of its bore, a pressure of only 22,400 pounds gives almost exactly the strain for the 3″.2 gun with a pressure of 37,000 pounds, and with a pressure of 30,000 pounds the strain upon the carriage is 27.56 tons greater than for the 3″.2 gun, yet the carriage is 229 pounds less in weight than the new metal one. The fact that the gun was heavier than the carriage, enabled the latter to withstand the excessive strain to better advantage than the new one, and another very important one was that the carriage was left free to move under the force applied. Owing to the weight and proportions of the system, and especially to the character of the powder used, the recoil was what would now be considered moderate.

The change in the quality and quantity of the charge, time of action, etc., have resulted in greatly increased recoil, even when the conditions as to the weight of gun and carriage remain the same. This is a serious evil, but by no means so great a one as a want of the proper degree of mobility, or power in the gun. These must be first obtained, and we must then get along with the evil as best we may. To correct this by first securing a light gun and then adding an unlimited amount of weight to the carriage, would be an absurdity, or to add enough to give sufficient strength to enable us to confine the recoil within the old limits equally so. Either would simply result in converting the gun into a huge hammer whose blows must ultimately destroy any carriage however heavy and strong it may be. Some effort must necessarily be made to reduce the excessive recoil, but this cannot be carried to such an extent as to impair either the mobility or power of the gun. Even if we must submit to double the

amount formerly obtaining, it is not a matter for serious alarm. We still have the same number of men around the gun available for running it into battery after each discharge, and more time in which to do it. In the horse-batteries the gun and carriage are so light that the amount of work imposed upon the men is of little or no consequence, while the field gun and carriage weigh 297 pounds less than the old 12-pdr., and the extra work will not become a serious matter, especially in view of the fact that the other operations of firing are greatly facilitated with modern breech-loading guns. Objection may be raised that the number of men, for this reason, ought to be reduced, for the reason that running the gun up, etc., exposes the men too much, as well as too many of them. This idea is about on a par with that other one that the guns ought to carry around a small, steel fort of some kind for the protection of the cannoneers. Thus far war remains a dangerous game, and when he takes a hand therein, the artilleryman must face the music with the rest. At the worst he is generally better off than his fellows of the infantry. He cannot afford to impair the efficiency of a battery simply for the sake of a little extra protection. The recoil should undoubtedly be controlled to the greatest possible extent, but the moment the effort or means required to do this involves any undue sacrifice of the mobility or power of the gun it should cease. With the position gun there will be found no trouble of any kind, for with it the restrictions are not confined within such narrow limits, while at the same time the conditions are more favorable.

Sufficient control of the recoil should be assured by the use of the road-brake for the gun-carriage. This should be so arranged that the cannoneer riding upon the left side of the carriage can apply the brake with his right hand when upon the march, with the lock-ratchet so arranged that when the piece is being fired, No. 1, or some other cannoneer can apply the brakes to check the recoil, and release it upon the piece being fired. For the horse-artillery gun much the same device will serve as is used by teamsters, a line attached to the brake-handle and fastened within reach to the harness of one of the wheel-horses, provision being made for readily unfastening the line from the brake when the piece is to be unlimbered.

Though the recoil must be greater than for the old guns, the new ones are lighter and more readily handled. The horse-

artillery gun weighs 43 pounds less than the old 3″ rifle, the field gun 139 less than the old light 12, and the position gun 197 pounds less than the old heavy 12-pdr. When both gun and carriage are considered, the difference becomes still greater, for the horse 146, field 297, and for the position gun 274 pounds respectively, less than for the corresponding ones of the old system.

When both gun and carriage are taken together as they must be when the gun is fired, the table shows that the carriages proposed should be more serviceable than any of those named, there being more material by which to secure strength as measured by the strains applied. Moreover, the relatively heavy weights of the guns assures the fact that these will be genuine strains, and not in the nature of the violent and destructive blows inflicted upon their carriages by guns both actually and relatively light.

It is not proposed here to determine with the necessary exactness the elements of the desired guns, but these can readily be indicated with sufficient accuracy to give a definite idea of what they should be, and how they compare with the best foreign guns of like character. The calculations for the proposed guns are based upon a powder space of 24.5 ; air-space 32, expansions 7.9—for the mountain gun these are 24.5 and 8.6, respectively, work of one pound of powder 99.23 f. t., loss by absorption of heat, through vent, etc., 34 per cent.

Kind	Mountain.		Horse.		Field.		Position.	
Nation.....	Fr.	Prop.	Spain.	Prop.	Ger.	Prop.	Ger.	Prop.
Caliber.....	3″.15	2″.74	3″.09	3″.07	3″.46	3″.45	3″.78	3″.95
Projectile.....	12.54	12	13.89	15.5	17.93	21.2	26.4	31.4
Charge..... ..lbs.	0.88	1.2	3.41	3.1	3.3	4.	5.94	6.
Initial Velocity.....	936	971	1492	1455	1456	1424	1470	1423
Length of Rifle-bore, in.	36.72	37.897	67.39	67.568	58.56	69.127	75.445	79.100
" Chamber.. "	5.28	*5.060	13.32	9.286	14.88	11.100	13.554	12.830
" Breech ... "	4.28	4.500	6.37	6.410	9.24	7.000	9.427	7.250
" Bore..... "	42.00	42.957	80.71	76.854	73.44	80.227	88.999	91.930
" Gun. .... "	46.28	47.457	87.08	83.264	82.68	87.227	98.426	99.180

* Inside of metallic shell, allowance must be made for its thickness, etc.

If it be not practicable to use a metalic cartridge with a compressed charge, with an air-space of 30, the length of the chamber for the mountain-gun will be increased to 6″.54, making the gun 48″.384 in length. With an ordinary cartridge the chamber will be considerably shorter.

ARTILLERY LOADS PER HORSE, TEAM OF SIX.

	Gun Carriages.			Caissons.		
	H. A.	F. A.	P. A.	H. A.	F. A.	P. A.
Limiting Loads, pounds...	520	612	779	662	705	712
Loads secured, " ...	520	614	743	620	695	702
Cannoneers, mounted.						
Limiting Loads, pounds...	570	662	829	662	800	829
Loads secured, " ...	570	664	793	620	790	819

With 5 cannoneers, which the field-gun will have to carry upon the road when traveling at an increased gait, its weight will be increased to 741 pounds per horse, that for the old light 12 being 729, and for the 3″ rifle with 5 cannoneers, 757. With the exception of those for horse artillery, the maximum loads are very nearly the same as have heretofore obtained in our service, and necessarily so; for we have practically the same horses and conditions of country as had our predecessors before us. With the exception of the Spanish horse-artillery gun, the degree of mobility is superior to any in Europe, as it unquestionably should be. As our horses are greatly superior to either the Spanish horses or mules, the comparison here is not disadvantageous. The projectiles are heavier- and if properly constructed, will hold more bullets, their terminal velocities at battle ranges are greater, and the ranges and powers of the guns are greater than those of like character in any service whatever.

It is evident that when common and well-known principles and laws of ballistics and mechanics have been duly followed, as well as the best examples of foreign constructors, to say nothing of our own in former days, to construct serviceable guns and carriages of the character indicated, requires neither exceptional excellence in material, in methods of construction, nor yet of great ability upon the part of the constructors. In fact, the problem is entirely devoid of difficulties, either professional or mechanical, and wholly within the command of any of our manufacturing establishments possessing reasonable means and ability in their administration. All of the rules and laws for such construction have long since been stated and their efficiency demonstrated time and again. Where these have been followed satisfactory forms of light weight and ample strength already exist, and even if it were impossible for us to devise new and better

ones, we can, at least, copy those now in use elsewhere. The old limbers and caissons have stood the test of war perfectly, but there is not to-day in this country a wagon-maker of standing and ability who cannot construct stronger, lighter, and in every way better ones. Extraordinary strength of material is not required for the guns, and instead of the costly steel guns, which are worthless after their days of service are over, field-guns, at least, should no doubt be made of aluminum bronze, with greater ease of construction, and at greatly reduced actual, as well as ultimate cost.

That such a system is practicable in every part does not admit of the shadow of a doubt, and if there be any validity in the claims for the superiority of modern material, and especially of our workmen, a decided improvement can be made upon this showing.

We at least should have the most perfect representatives of all of these guns, and at once; designed and constructed to fulfil the various conditions of field artillery service, as was originally the intention, so expressed in the Report of the Chief of Ordnance for 1883, p. 289, when the 3″.2 light field-gun, weighing only 722 pounds, was designed. The present gun is obsolete and of too small caliber for a field-gun, and, without radical changes, cannot be converted into a satisfactory horse-artillery gun and satisfy the conditions as to mobility.

It is proposed to establish a Light Artillery School, and it is to be hoped that those who have had the advantages thereof will not be compelled to acknowledge that, "having received all of the military educational benefits the Government can furnish, they have yet to *see* a modern gun of any kind, much less having had any practical use of one;" the present status of nearly every artillery officer in the United States Army respecting not only field, but every other kind of guns. We might as well expect to become accomplished machinists by studying the pictures of the tools and handiwork of one. Until we have at least the representatives of the required guns, we cannot have even the pictures to study, much less perfect ourselves in the practical uses of the guns themselves.

Errata.—Page 322. In third line "admissibly" should read *admirably*.
322. In eleventh line one-fourth should read *one-fifth*.
323. In second line "224" should read *244*.
325. In twenty-ninth line inefficiency should read *efficiency*.

INDIA.

By LIEUT. COLONEL HENRY M. LAZELLE,

Twenty-Third Infantry.

ABOUT sixteen months since I was ordered by the War Department to India, for the purpose of witnessing and reporting upon the military maneuvers of the armies of that country, to take place during the winter of 1885-6; and as I was not ordered to do anything else, it is somewhat in the spirit of gossip that I venture to comment upon matters and things outside my mission. *Enroute* I passed through Europe and confess, to an utter lack of admiration of a Southern European winter; I rejoiced when at last the steamer hurried me away from Italy—a land fruitful of murky skies and freezing and musty hotels; swarming with beggars; abounding with cheese, dirty snow, macaroni, and shameless art—and when at last we shot along "o'er the glad waters of the dark blue sea" toward the shores of Africa.

A proper introduction to India is Egypt, because it lays first on our roadway; because it is a necessary and an appropriate avenue of approach; and because of the positive kinship between all Eastern nations.

On the fourth day we were to arrive at Alexandria, and I was early on deck. It was still the gray light of morning, but in the distance, landward, the sky was lighted with the crimson and gold of a truly Eastern dawn. Silhouetted against the fiery horizon were dark masses, walls and roofs, spires, minarets, towers and bulb-like domes without number, of the ancient city, all intermingled with the peculiar and unmistakable outlines of tropical verdure; to the left these stretched away into misty tracings, and to the right they were strewn, as far as the eye could follow, into

the haze of the desert. Under the growing light and a nearer approach, the lovely picture was less beautiful but more distinct. The review of outlying forts, still in ruins, was succeeded by groves of orange trees and gardens brilliant with flowers: villas which angels might covet; palaces of pure white marble and of novel yet gorgeous architecture, whose terraced grounds extended to the sea; magnificent mosques and the stately Pillar of Pompey were all before the eye. Then came the hum of swarming life. Countless boats, like unclean birds, were heading for our ship. There were pilot boats of startling models, with the stern and beak of a Spanish galleon; fishermen's boats filled with piratical-looking oarsmen and dressed as though they had been decorated from a child's paint-box; traders' boats, with the Arab Jew in the stern, hawk-like and eager, with the "You-wish-to-buy-some-dings" look, which they have worn ever since Jacob bought out his brother Esau, all dashed towards us, and swarmed around as the ship slowed up to the wharf.

Then followed the bustle of landing: we crowded out with the rest, and were for the first time in Africa, the land perhaps of our ancestors. But we were also on soil historically sacred. Here was the once mighty city of the past; Alexander the Great had marked its magnificent site and traced its outlines. Here, within a day's travel, were the the ruins of haughty Carthage, the rival of Rome, the Mistress of the World. Here Cleopatra once balanced her loves against the safety of the state, and Roman emperors, bewitched, became oblivious of their crowns; here once rolled the chariot of Julius Cæsar, who bent to her loveliness until he had nearly forgot his army and his ambition. Here the great Pompey was beheaded; here was the vast library which for ages was the repository of the learning of the world. On these very shores the mighty Napoleon once marshalled his armies. This was the home of Cheops and Sesostris, as well as the country of the great Jewish lawgiver. In a word, this was Egypt, which once gave law to the world, and is now the tomb of her oldest civilization. In this sacred city once moved the three mightiest men of the earth: Alexander, Napoleon and Cæsar—Cæsar, the greatest of them all.

While I stood apart from the crowd, indulging in these thoughts, a man came toward me whom I at once recognized as Moses: and I was glad to see him. He had on the same robe, girdle and sandals, and there was the white hair, the long beard

and venerable presence. Slowly and dignifiedly he approached, raised one hand in respectful salaam and extended the other saying solemnly: "Back-sheesh!" Vanish, shades of the past, for we are in *modern* Egypt, a land of beggars and corruption. Let us look around; what do we see? Mongrel costumes, all Arabic and Oriental. Sandals, with or without stockings; loose trowsers, gathered at the waist; a tunic-like jacket, and over all a robe, and a turban head-cover. The dress of the women is similar, but less distinctive; the trowsers more baggy, with a skirt-like envelope; the rebosa at once a shoulder and head-wrap.

But here are the cleanest, best paved streets in the world: solid blocks of sienite eighteen inches square, brought at enormous expense from Italy. The city has two quarters: native and foreign. The foreign looks like both a French and an Italian city. The native quarter is built up chiefly of adobe and rubble stone; a few handsome, but many humble dwellings; the shops small, unattractive and dirty. In the foreign quarter are modern vehicles and street cars, without a rail-track however. In the native quarter are camels, carts and men carriers; and in both quarters are multitudes of donkeys for packing or riding. It is a city of palaces built by the former Khedive, which are monuments alike of his boundless passions and his reckless extravagance—palaces of his many favorite wives, of his ministers, of his sisters, his cousins, and his aunts. Each of his numerous relatives demanded a palace, the counterpart of all the others; and one is reminded of poor Brigham Young, who, to keep peace in his family, was compelled to purchase forty-four breast-pins just alike, one for each wife. The carriages of the wealthy are preceded by a herald foot-runner, dressed in rich finery of embroidered gold and silver, whose staff and costume at once indicate the rank of the family. As he runs, he shouts the warning: "Guerda"—make way. But none are too poor to ride; it is the paradise of the beggar on horseback. A saddled donkey is hired for the smallest copper coin, and the Arab owner runs behind, whipping him into animation. Race aristocracy is dead in Egypt, for the rider may be the laziest and blackest of the half-dressed negroes, and the runner behind a fine featured Caucasian. The natives are chiefly Mohamedans, with few Jews. All women are veiled when they appear in public, the contrary is scandalous. The veil is fastened to a cylindrical nose-piece, which in turn is supported by a middle band passing over the head, both eyes

and the lower forehead being thus fully exposed. But it would be cruelly unjust to the sex to say that lovely eyes, even when thus hampered, cannot convey as much meaning as when supported by the full orchestra of the face. Strolling along one day, I saw a black, strapping negro girl approaching; as she neared me she coyly arranged more securely her face-gear, and then demurely and sweetly cast down her eyes; thus proving that the negro woman is as good as the white man.

But why tarry here? Cairo is only five hours by rail, and the everlasting pyramids only fifteen miles beyond. Carried there, we find a vast city of 450,000 people, in most respects the counterpart of Alexandria. It is the capital and the center of intrigue and luxurious living, and swarms with functionaries, natives and foreigners; it has multitudes of palatial residences, gardens, mosques, fine drives and novel promenades. The native quarter is a great labyrinth of dirty, spawning life; with few streets broad enough for carriages and with tortuous twistings enough to form an elaborate child's puzzle. Many of the tiny shops or booths are filled with costly wares; though little or nothing is displayed, the only indication of the kind of goods sold being the manufacture of them going on about the door.

On my return from this stroll I came upon a Mohammedan wedding-procession, and eagerly joined it. The bride, jeweled and veiled, and accompanied by her attendants and family, was slowly journeying on foot toward the house of her future husband; a canopy was carried over her, and the procession slowly marched to the sound of melancholy, screeching music. The Mohammedan never sees the face of his beloved until she is declared his wife, and unveiled in his own house. His optimistic tendencies easily reconcile him to this method of marriage, but the average American would hardly be willing to take his chances in such a matrimonial grab-bag.

One of the novelties of Egyptian streets are the money-changers and brokers; they have little stands with glass-cases of coin, duly guarded, and will, for gain, change any coin of the world, known or unknown. After seeing them it is not difficult to understand how a certain great Teacher, in his anger, easily overturned the tables of the money-changers in the Temple of Solomon.

Glass is little used in native houses; the windows project over the street, and light is admitted through lattices; the win-

dows of the women's apartments being jealously guarded by an enveloping frame-work of wood, exquisitely carved into interstices, affording light as well as peep-holes for the inmates.

Tired of the streets we started early one morning for the Pyramids. After driving through thousands of camels, tied nose and tail in interminable strings, on their way to the city with all sorts of burdens, we arrived at about eleven at two great mountains of dirty—almost black—sand-stone, standing apart on a rugged, sandy plain. The sides were rough and broken into irregular steps or offsets, about four feet high; the tops were crumbling away, and around the base, on each side, were masses of debris. At a little distance the great head and shoulders of a human figure in black sand-stone, peered from the barren plain, its top about fifty feet high; on approaching it closer the semblance to the human face became much confused, the outline almost vanishing in its hugeness. These were the so-called mighty Pyramids and the wonderful Sphynx. They are great in nothing but the slavery of hundreds of thousands who perished in their erection. They served no compensating purpose, and represent nothing but the life and death-power of former rulers over the swarming multitudes who once toiled here. I sat down in moody contemplation of the mighty gap opened between my long-cherished ideal of the pyramids, and this dirty commonplace actuality, and was enraged with a group of Arab boosters who came up and proposed, for the sum of ten francs, to pull and boost me up to the top. On retiring they were followed by an athletic fellow who proposed to run up to the top of the great pyramid, then down and up to the top of the other, all in fourteen minutes, for five shillings; this was business: true American enterprise; grotesquely absurd, the idea exactly harmonized with my supreme contempt for the whole display; I had heard of marriage by proxy; why shouldn't I ascend the pyramids by proxy? I closed with the fellow at once, and sitting on a rock, lazily watched him, sincerely hoping that he would tumble somewhere and break his neck.

Of far more interest to the visitor, and the world, are the excavations of dwellings and tombs now going on near the Pyramids. These are built of immense slabs and massive columns of red porphyry, highly polished and solidly placed together without cement, and as the desert sand is removed in which they are

buried, it is seen that these builders of long ago had an extended knowledge of both architecture and art.

An arched entrance of about fifty feet from the ground in the side of the great pyramid has recently been discovered and opened; it leads to tombs of former royal families; and, as from them had been taken a few weeks previously, and placed in the museum in Cairo, the mummies of Pharaoh and his daughter, we resolved to go there and call on them as a matter of respect to Moses. We found the family comfortably settled in beautiful stone coffins, the tops of which had been removed; but ancient hieroglyphics in gold characters on the cases identified them fully, even if the royal expression of their countenances did not; the father, mother and daughter had the complexion of plum-puddings. Pharaoh has the thin, narrow head of a country squire—a strong jaw and snarling expression, but a few hairs still lingered on his time-worn skull; his wife had an old and worn look, and the thin lips and tightly closed mouth of the daughter indicated that courting her must have been a rather depressing pastime.

The museum contains an immense collection of exquisite gold and silver ornaments, ancient weapons, household vessels of copper and glass, carvings in stone and even wood, all perfectly preserved. The jewelry is beautifully wrought, much of it similar to the present Etruscan designs; and to-day, the bracelets and necklaces, and the delicate intaglios would adorn the person of any lady.

The great mosque of Cairo is built wholly of lovely alabaster marble which once covered the great pyramids, but which has been stripped from their sides by the Mohammedans; we hired a pair of sacred sandals and were conducted through it. As a structure it is of wonderful beauty and extent; but its chief interest was the ancient, so-called, Well of Joseph, which it incloses, and the great citadel of masonry which it surmounts. The mosque stands on the top of a dome-like hill, whose sides, from the base up, are scarped into successive terraces and faced with massive stone-masonry, each height outlined with parapets, and each a complete fortification line. It is garrisoned by several thousand native and English troops, and is one of the strongest land forts in the world.

Inside of the mosque is the Well of Joseph—an unrevetted hole in the ground, forty feet in diameter and 460 feet deep; a

corkscrew-like tunnel, bored through the hard clay, follows around and around it down to the water, which is 300 feet from the top; but the sum that I paid for a guide, and a tallow candle, to walk around through this slimy pitch-dark cavern to the bottom was more than compensation for my fool's journey.

My last day in Cairo was pleasantly passed in visiting the spot where Moses was found by Pharaoh's daughter, and in a presentation to the Khedive at his palace. The hiding-place of Moses is an embowered nook of a garden on a charming island of the Nile. The island is devoted exclusively to the palaces of the royal family; the spot is inclosed and religiously guarded, and whatever else one may think of this ancient story, he must admit that Moses' mother had very good grounds for hiding him.

The Khedive had graciously fixed an hour for seeing me, and I was promptly on hand. But princes and clowns are uncertain; and it was not until after a tedious delay and much ceremonious palaver with court functionaries, who kindly sought, through interpreters to interest us, that we were finally conducted through multiplied halls and corridors, into the very pleasing presence of the Khedive, the figure-head of Egypt, for he is nothing more—an attractive-faced, unpretentious gentleman who speaks English perfectly. After a moment's standing I was invited to a seat near him, and had a delightful visit. He is a sincere man—a Mohammedan in religion only—a man with one wife. He is an economical, conscientious ruler, and is striving to undo some of the riotous mischief of his dissolute father, whose creed, like that of Madame de Pompadour was: "After me the Deluge!"

We visited at Cairo the magnificent Opera House and heard a French company. A marked feature is the absence of Mohammedan ladies from the audience, but they are otherwise looked after, the dress-circle being set apart for them; this was veiled off by a thin curtain of lace, and, while it afforded the occupants a view of the stage, to the curious infidels in the audience it gave most pleasing glimpses of lovely faces.

But our Egyptian time was up, and declining a cordial invitation to accompany English officials 600 miles up the Nile, to Assouan, we started for Suez.

A word before we turn our faces toward India. The descendants of Arabs and Turks are now the dominant races in Egypt, and they rule in corruption and lust. The Egyptian of to-day:

the sole representative of the great Rameses, is the wretched *felleen*, a toiler, a scavenger and a slave, from whose blood is wrung the annual income of the State. His life is as degraded as are his political and moral debasement; utterly without education, half-naked, destitute of everything—he merely exists as do animals. Their villages are clusters of round-topped mud huts, joined together as mud-swallows join their nests. They are taxed by villages, and, to escape the extortionate tithe-gatherer, keep their backs from the lash of their chiefs, and to hold their miserable hovels they must work from dawn till night. They are of full stature and muscular build, and their complexion suggests the African, and their profiles the Jew; but in character they are wholly unlike either. But like degraded races everywhere, they are, when aroused, fiercely brave, and now and then there flashes out the heroic spirit of the ancient people. In the Egyptian campaign against King John, of Abyssinia, and under that great ruler, Mehemet Ali, the poor felleen, trained and led by soldiers, showed that he was still worthy of the sympathy of the world.

Mohammedism has accomplished for Egypt, during its thousand years of dominion, all that it is capable of accomplishing. It has outlived the original mental and physical vigor which characterized it, and is dying, and with it must die every nation adhering to its tenets; therefore, outside of political considerations, it should be a matter of congratulation that England has seized upon Egypt, and will retain her hold there. Every foot of land of lower Egypt is under cultivation; corn and wheat, cotton and sugar-cane, bananas, dates and oranges grow in the same field. Always two, frequently three, and sometimes four crops a year are gathered of some products; and if Egypt yielded in ancient as she does in modern times, it is no wonder that food there was always abundant; that the population swarmed; and that, when all the world suffered from famine, the sons of Jacob went down into Egypt to buy corn.

We embarked at Suez upon a somewhat prolonged voyage to Bombay, through the sea called Red, from the color of its shores, but whose waters are as charmingly blue as those of the fascinating Mediterranean. We passed in full view of the somewhat insignificant-looking mountains of Sinai, and within seven miles of the wells where Moses and his people halted for the first time on their escape from Egypt. We passed the port of Jedda in

Arabia, where they point out a grave forty feet long, containing the remains of our great common mother, Eve; and sailed by Mocha, from which, no doubt, comes the delicious coffee of the Subsistence Department of our Army.

Our ship contained all the nationalities of the earth. Our captain was an Englishman; the crew Mohammedans; and the passengers Greeks, Arabs, Australians, Jews, Persians, and East Indians; embracing languages enough to break up the building of Babel. I felt quite like a foreigner, and thinking that I might be able ultimately to acquire broken Hindoostani, I devoted some little attention to the language. My seat at the table was next the captain, and after lunch one Sunday, he remarked to me, "I did not see you at Tiffin to-day?" Supposing that he referred to the church service of the morning, and not wishing to appear densely ignorant of so common a Hindoostani word, I replied: "No, I do not always attend service." "Oh," he said, "I don't mean that, I mean that you were not to lunch." This broke up my school of Philology, and after that I spent my time in looking over the ship's side and wondering what had become of Pharaoh.

I should have said before, that, at Suez, we had been officially received by Colonel Upperton, of Her Majesty's Indian Army, and that our party now consisted of eight foreign officers—two from each of the four countries of America, Russia, Germany and France; the representatives of Italy and Austria—the two other countries sending officers to India—having preceded us to Bombay. We were now, therefore, first-class military tourists, "personally conducted," as are lunatics, and with everything except our clothes, provided for us by the Government of India.

Forty years ago, the English having firmly established themselves in India, saw the necessity of the maritime supremacy of the Red Sea; and therefore seized the Island of Perrim, at its entrance, and, after hard fighting with the Arabs, the Port of Aden and the surrounding territory in Arabia.

No sooner had our steamship dropped anchor in this port than the official barge of the English Governor approached with his aide, bearing a cordial invitation to us to visit the port. After a drive through the town and its marvelous fortifications, we dined with the Governor, and at a late hour returned to the ship. The heat on shore was excessive, and at the Governor's house I was shown the beauties of the punkah, a feature of comfort

adopted throughout the torrid climate of the East. It is an immense padded fan of bamboo, about four feet wide, hanging vertically the full length of a bed or table, and is swung by attached cords which pass over pulleys into rooms adjoining. During meals, and all night and all day, if desirable, these are kept in motion by relays of servants. The pull *down* of the cord gives the hardest swing, the most air, and to those fanned it is the coolest; this is called the "*Bengal*" side of the punkah, and the opposite the "Bombay" side.

As we lay at anchor, I was greatly interested in the swimming exploits of hundreds of Samoli negroes, a brave and fierce race from the neighboring coast of Africa, who swarmed around the ship utterly indifferent to the presence of sharks and devil fish. For a silver sixpence thrown into the water from one side of the ship, they would dive under the ship from the other side, almost invariably getting the sixpence.

Aden, as a naval and coaling station is so important to England that unlimited labor and expense has been devoted to rendering it immensely strong. It is built literally on the solid rock, and its fortifications are hewn out of the mountains from base to summit, both on the sea and land side, the two sides being connected by tunnels through the mountain chain. The place is almost impregnable. The entrance to the Red Sea is through a ship channel of not over one and a half miles wide, fully commanded by fortifications on the black, dismal and barren island of Perrim. So long as England holds these two points, and maintains control of the Suez Isthmus, so long is her road to India free. Leaving behind us these evidences of the grip and greed of England, we pursued our torrid way through the Indian Ocean: passing our nights in gazing at the beauties of its phosphorescent waters and the glories of the Southern Cross; and our days in yawning and in trying to answer the following three monotonous questions to which we were doomed by every one: "Is this your first visit to India?" "Will you remain long in the country?" "What do you think of this part of the world?" My answers were; "Yes," "No," "Quien Sabe." But I suspect that, like the recruits of Frederick the Great, I was regarded as a "little off," because I sometimes mixed up these answers. I was gratified one day, however, to hear a certain Prince of our party say in reply to these interrogatories: "I shall spend ze time to hunt

wiz ze tig*ar*," for I sincerely hoped that the tig*ar* would be successful.

About the last of December we arrived in Bombay, and at once took up quarters at a ram-shackle hotel, half Western and half Eastern, kept by an Englishman named Cowasjee Dadabhoy Furdoon Kuthoke. Here we were joined by the four remaining foreign officers, and, from this time on, for a period of about five weeks, I was incessantly occupied and without a moment that I could safely say was at my own disposal; every day was fully taken up with expeditions, here and there, entertainments, visits of ceremony and receptions by civil and military functionaries, etc., almost every occasion requiring a change of costume, until it seemed to me that, when I was not going or coming, I was changing my clothing, and at last I fully appreciated the sentiments of the man who committed suicide because he was tired of dressing and undressing. To illustrate my meaning and then drop the subject, I will outline a few days' work in Bombay:

Arrived Tuesday, by steamer. at 2 P. M. Dined at Royal Yacht Club. Wednesday morning, official visit to Commander in Chief of Bombay Presidency. Afternoon, visit to Government Horse Training School; evening, dinner and reception given by Sir Robert Fair. Thursday morning, sail to Elephantine Caves in Government steamer; afternoon, lunch with the Lord-Chief-Justice; evening, dine at Bombay Club. Friday morning, visit Towers of Silence; afternoon, visit the Troop Ships; evening, dine with His Excellency, Lord Ray, at Bombay Government House; and afterwards attend a ball given by civilian authorities.

Bombay is an immense city of 800,000 people, with wide and cleanly streets, and many beautiful buildings. Space does not permit a description of these stately structures, nor of its broad squares, lovely parks and fine drives. It has many cotton, jute and leather manufactories; manufactories of Government stores and of native goods, and innumerable shops where are displayed the exquisite wares of the country. It is not only a vast mercantile and commercial point of India, but of the world; and through its streets swarm the life, and intermingle the costumes, of every nation. The residence portion of the city is divided into four distinct quarters: Mohammedan, Parsee, Hindoo and Foreign; the buildings and character of each quarter being those peculiar to the class.

Of the Foreign quarter it is unnecessary to speak further than to say it is like a section of a great English city. On the seaward side is quite high land sloping toward the sea and toward the city; this is Malabar Hill the aristocratic center of the foreigners.

The Parsees are pure blood descendants of Persians expelled from their country 1500 years ago. They are a highly moral people, of elegant manners, large business capacity, and are great managers; they are the native bankers and speculators of India, and are located chiefly in the maritime cities. In religion they are fire-worshippers—followers of Zoroaster. While not regarding fire as a sacred element, they believe it represents the spirit of purity, and that it is the material, outward expression of the Divine essence. The dress of the males resembles that of Europeans except that the trowsers are of bright colors, and in place of the coat is worn a loose garment of dark stuff, not unlike a dressing-gown; while the cap is that of a high-priest of the time of Aaron. They cannot intermarry with the Mohammedans or Hindoos, and I am not sure that they want to. Their marriage and their burial dress is the same—a pure white, the propriety of the similarity of costume for these occasions, probably having been suggested by a dismal apprehension that the future of each of these states is somewhat similar.

As the final resting-place of these people differs slightly from the simple country churchyard, of the average poet, I will describe their cemeteries which are appropriately called Towers of Silence. An immense area, strongly inclosed, is planted in flowers and lovely shrubbery, and the grounds beautifully laid out—no expense being spared. Within this area is built a circular tower of solid stone-work of about 200 feet in diameter and eighty feet in height. Inside the tower, and fifty feet from the ground, is a stone floor, sharply inclining toward the center, where there is a deep well extending down far into the earth, below the tower. The entire floor is cut into shallow hollows, each of which has a drain, all the drains running toward the central well. The floor will accommodate about 3,000 bodies of the dead. At the base of the tower is a solitary iron door, and, at about twenty feet from the top is one narrow slit in the solid wall, these being the only openings from foundation to summit. A high, iron, barrier fence, around the tower, and 200 yards from it, forbids any approach of the curious. Within this barrier no one, whatever his rank or position, is allowed to enter, except

three or four men who are the consecrated carriers of the dead, and keepers of the tower; nor, as they are forever unclean, are these men ever permitted to pass without the barrier, their food and clothing being supplied to them. At funerals the dead, placed on biers, uncoffined, covered with white robes and flowers, and tenderly followed by loved ones, are brought to the barrier gates; there they are taken leave of and committed to the keepers of the dead, who bear the body into the tower, strip it of all vestments, and lay it on the inclined floor, where it is abandoned to the thousands upon thousands of vultures which, perched upon the lofty walls of the tower, or darkening the air in sluggish circles, have been impatiently waiting for their horrible feast. When the bones are picked clean the skeleton is dragged to the central well by the living ghouls and thrown in, and this is "the end of earth." As these loathsome birds have their nests in the crags of adjacent mountains, and their young are fed from human flesh carried there, perchance dripping with decay, over the beautiful garden, I was interested in a young English lady present who sniffed with great satisfaction a bouquet of lovely flowers gathered in this Parsee inclosure, and possibly within a stone's-throw of the iron barrier of the dead. A word more, that there may be explained the object of the solitary aperture in the wall of the tower. From the moment of sunset until its rising, there is turned upon this aperture, by a powerful reflector, a brilliant light from a building occupied by the guards, who watch over the Towers of Silence; the light being to the Parsee mind typical of the Divine Spirit present with the dead and the living alike.

We turn with satisfaction from these melancholy contemplations to the cheerful surroundings of the Hindoo crematory, to which we gained admission by special authority. Here, within a large walled inclosure everything was going on in the open air. Half a dozen fires cheerily cracked and sparkled under long, open, grating-like iron frames, within each of which could be seen late Hindoos in all conditions of done, overdone and underdone. Men nearly naked, were briskly carrying wood to start the fire under a fresh arrival, while others were stirring up fires to finish up some obdurate roaster, slow to burn to a black coal. When the cooking was complete of any subject, a jar of ashes was scraped up, just as likely to be his as not, and carried out by the fireman to the waiting relatives. Another candidate was

then lifted into the frame; and so the good work went on. As we passed out into the "Queen's Road"—the ultra-fashionable drive of Bombay—we saw that only the high wall of the Hindoo inclosure separated these two pictures of the past and present.

Until comparatively recently the practice was general of sutteeism, or the burning of the wife with her husband's remains, though it is now forbidden by the English authorities. It is said to have had its origin in the fondness of the women in former times for the use of subtle poisons in order to summarily divorce an unsatisfactory husband. The physical pain of this sacrifice was not so great as it would seem, for the woman was usually stupefied with bhang, until nearly insensible, and then pushed by her friends upon the funeral pile. Only the religious law and the law of caste enforced this practice; it was not compulsory; a woman could refuse to burn on her husband's pyre, but she then became an outcast: and so rather than to be without friends or associates, and under a withering social curse, she thought it better to die than live.

The dwellings of wealthy Parsees resemble French villas of the renaissance period. They are usually isolated in position, and the surrounding grounds are most attractive in the flowers, shrubbery, fountains and statuary which, on all sides, greet the eyes. To avoid the great heat a duplicate house shell, with doors and windows placed exactly opposite those of the interior, is built over the interior house, with an open interval between the two houses of about fifteen feet, the corridors having connecting stair-cases. By invitation, I visited the residence of a Parsee gentleman, who spoke English perfectly, and was there presented to his wife and daughters. They were graceful, easy in manner, composed and dignified in conversation, and like many ladies were utterly insensible to admiration: in fact, they were novel in nothing except in dress which much resembled that of the pictured Roman matron. The house was richly and elegantly furnished in all that is costly and tasteful of Eastern devices, and everything suggested luxurious ease and the delight of living.

The residences of the Hindoos are almost invariably in the closely-built streets of the cities; the fronts having open corridors above the first story, with hanging matting to ward off the sun's rays. They are a social, chatty, company-loving race, and the families, males and females, live mostly upon the street or in

the corridors of their houses. The Mohammedan dwellings of the wealthy are, on the contrary, almost dead walls, exposing to the street nothing but the door and a few closely latticed windows, sometimes projecting, balcony-like, over the street like those of Cairo, already described. The houses are usually square inclosures, with interior court-yards and corridors above the first story.

The Mohammedan and Hindoo women are as opposite in manners as the styles of their houses. The Mohammedan woman is hooded, cowled and veiled, while the bright-faced and sparkling-eyed Hindoo lavishly displays her beauty of face, and heightens her attractions of figure by every art of dress of gorgeous yet harmonizing colors: sandals, highly ornamented, pantaloons of rich silk, artistic petticoat and graceful shoulder and head robe, complete an attire always rich and sometimes fascinating. From the left nostril of the Hindoo belle depends a handsome nose ring of gold from one to three inches in diameter; the toes of her delicate feet are circled with rings of silver, with showy and jingling pendants, and her wrists and lovely ankles are ornamented with bands of solid gold.

The dress of the men consists of loose trowsers, jacket with a tunic, over-blouse, and over this a toga. The lower classes, in hot weather, wear nothing but trowsers reaching from the knee to the waist, and these not unfrequently abbreviated in both directions, while none but the higher classes have trowsers reaching to and gathered at the ankle; no man, however, is too poor to be without a turban; or in its absence, a cloth wrapped like a turban. The material of the turban and other parts of the dress vary greatly in cost and richness, but the value and style of the turban always indicate the social rank and often the caste of the wearer, and it prominently marks the Hindoo gentleman. The entire dress of the rich is often of costly silks and satin: that of the poor of the coarsest cotton; but both select the brightest shades of colors, and all classes wear the varieties of dress of their particular caste and occupation, each occupation representing a distinct caste; thus, the barber, the courier, the tailor, the peddler, the water-carrier, the goldsmith, the scavenger, etc., may all be recognized by a distinctive dress never departed from. The caste of the better dressed class is also indicated by a caste mark of some color always made on some part of the face when in full costume. So, too, those of the same caste and occupation

usually live in communities: thus there are grouped together the streets of the coppersmiths, of the goldsmiths, of the wood-workers, engravers, sandal-makers, embroiderers, turban-makers, etc. The occupation generally descends from father to children, and, though caste is not lost by abandoning a craft, still, ancestral occupation is very controlling, and I saw at one of the art pottery works, a potter at his wheel who, with great pride, traced his lineage unbroken through preceding generations of potters for 500 years.

India has been for ages a land of fixed customs, fixed employment, fixed religion and fixed ideas; nothing was old enough to be forgotten and nothing new enough to be learned. Her forms of religion and civil institutions were crystallized long ago; since then, mental motion has ceased and with it progression; and the nation, like an old man, sits in contented ease muttering monotones of the past. As communities and nations, like individuals, follow a course of birth, growth, maturity and decay, and, as it is well for men to die that the vigor of the world should be held up with young life, so it is well that old races should be supplanted by new, and old nations invested, forcibly if need be, with new civilization.

In the heart of India to-day are repeated the identical processes of living seen by Alexander the Great; and so closely linked are the nations of the East, that one may there in his daily walks see the brickmakers of Ancient Egypt; Rebecca at the well; and the shepherds of Judea. Deserts are crossed now as in the time of Abraham, and if the people to-day were to stone Stephen to death, they would probably first stir up, as of old, the chief women. Our biblical friend Lazarus, the beggar, many times duplicated, is met at every corner; he persistently dogs the stranger from shop to shop, and will run for miles after his carriage, thankful for the smallest copper coin; wherever met they appealingly extend the hand and piteously cry: "No Fadder, no Modder," and if they are as truthful as other beggars, it is unquestionable, that very many of the population were born with neither father or mother. Food is surprisingly cheap; 100 pounds of vegetables are sold for less than four cents, and fish in about the same ratio; but rice, wheat, and all breadstuffs having a foreign market, are higher, for the natives have not been slow in appreciating the significant fact that India stands now the third nation in the world, of wheat-producing countries.

The wages of labor are somewhat greater than formerly, but are yet so trifling that, in agriculture, manual labor is cheaper than machinery work. The manager of an indigo plantation informed me that it would be a loss of money to introduce machinery from England because any number of men could be had who would work nine hours a day and find their own food for less than six cents a day. Yet, unless one lives as the natives live, the cost of living in India is by no means small; labor is so classified that even to the minutest divisions of occupation one must have a servant professing that particular class of work to do it; this entails in every European household an army of servants, and when all are fed and paid, it amounts to as much as the cost of servants at home.

There are no cooks in the world more accomplished than the caste of cooks. As already intimated, their skill comes from inheritance as well as experience, and one's astonishment perpetually grows at the immense variety of dishes which they concoct from a single meat. They hesitate at nothing in uniting components which we are accustomed to think impossible, and they appreciate fully the art of seasoning.

No laborer, wherever found, except the Egyptian *fellcen*, toils so hard as the native field-hand of India. Here men, women, and children, with only a turban and scant clothing to protect them from the blazing sun, labor early and late. Throughout an immense area of Central India the soil to produce must be irrigated, and, as the country is very flat, this is done by incalculable labor as the water must be first lifted from wells, and then conducted over the fields. These wells are very numerous; they are about thirty feet in diameter, are uncurbed, and many of them very deep. There are nowhere either fences or dividing field-walls, and, in passing from Lucknow to Allahabad, I saw one continuous wheat-field over 100 miles long and more than fifteen miles wide. It is in such areas that the deadly cobra lurks, whose bite is estimated to destroy 20,000 people yearly; he strikes without warning the naked feet and limbs of the poor native who, as he has no positive remedy for the poison, generally dies. But with this enemy in the field, he has at his humble mud-thatched home one far more deadly: this is the small, swift-moving kerite, a snake which delights in haunts of humanity. Its bite means inevitable death and within one hour the poor victim is in the grasp of Siva, the destroyer.

While at Bombay we visited the so-called Elephantine Caves. They are on a rocky island, about twenty miles from the city, and are a series of immense chambers hewn out of solid granite rock. The face of the great cliff is cut into a temple-like front, the mighty façade being supported by massive Egyptian-like columns with a flight of stone steps leading from the water's edge to the temple entrance. The vast interior of each chamber is a dome of great height, supported by rows of huge pillars; while ranged around the side walls of each chamber are stone representatives of Hindoo deities, gigantic in size and exquisitely chiseled in the solid rock; those of least importance being in the chambers nearest the temple-front. In their aggregate these deities form the entire hierarchy of Hindoo divinities, and by attitudes and surrounding symbols they are supposed to explain the origin of man and the trinity of Gods, all proceeding from the first God Brahma, the Creator. These temples are among the oldest in the world of which any vestiges remain, and their origin is lost in the mists of the pre-historic; but the religion here depicted is that of the Hindoo of to-day, in both faith and practice—both absolutely unchanged.

The natives throughout India, though of the Caucasian race and type of features, vary in color through all shades from mere brunettes to a positively dark-skinned people; and in Cashmere, and in other Northeastern districts they approach the eye obliquity and the saffron hue of the Mongolians. Though fierce in anger they are everywhere, outwardly gentle, refined and polite; they greet one by bowing the head with the right hand on the heart, while the word "Sahib"—master—is perpetually on their lips. They are people of devoted attachments, fairly honest and truthful, and, religiously good, except when driving a bargain with a stranger; then, they are expert liars, always asking five or eight times the sum for an article that they will finally gravely beg you to give them for it, and solemnly swearing that "this is far less than cost." The favorite means of locomotion are the tonga, the dhooley, and camel, horse and elephant riding. The dhooley is a basket-like inclosed frame, admitting of a single person in a lying or sitting posture, and is suspended from poles carried on men's shoulders; in this, with proper relays, one can travel forty miles a day. The horse we all know about; the camel I did not try, though repeatedly invited to do so, partly for the reason that I did not know Hindoo camel talk; partly because

that meek animal has a savage habit of biting the legs of his rider; and partly because I did not think I would be a success in steering a camel about by a string through his nose. The tonga is a two-wheeled vehicle without springs, and with stout shafts supported by an iron yoke passing across the shoulders of two horses. The driver sits in front of the wheels and his one or two passengers near the end of the cart behind, riding backwards; without the smallest reference to their speculations, he makes it his sole business to keep his animals in a vicious gallop, and, after a ride of forty-five miles in one of these exercisers, which I one day took, I felt as though I had been in a modern hash machine. At the time my sole knowledge of Hindoostani consisted of the words "Jeldi Jow," faster, and "Roko," slower, but before I had traveled many miles I think I must have got these two words badly mixed up, as they had no effect on the driver, and much of my subsequent conversation with him was in very forcible United States dialect. A four-wheeled modification of this outfit is a vehicle with a pagoda-like top, highly ornamented, and drawn by a pair of hump-backed oxen trained to trot, this though not a speedy method of traveling, has the merit of having been fashionable for 2000 years.

The last day of my stay in Bombay I visited the Market; the Native Parsee College; and in the evening a Mohammedan Fair. The latter was held in an immense inclosed quadrangular garden, beautifully lighted up, thronged with native men and closely-veiled women, and arranged with multitudes of booths at which were sold all manner of novel and beautiful objects. In the center of the ground was the inevitable mosque with its presiding dervish, while around the temple swung dancing-girls in figures not ungraceful, but to the measure of somewhat dismal music.

The markets of Indian cities are bountifully supplied with fish, vegetables, grains, tropical fruits, and all sorts of goods useful to the natives; and there are fine displays of lovely flowers, of which the people are passionately fond. Animals and birds are also for sale: Singers, talking parrots, pet monkeys and the mongoose, a trained snake-catching animal, and even tigers in cages. But what was by far the most interesting were the magnificent horses from Persia and Arabia; these countries are the native homes of the horse, and he is here in all his perfection; he is so beautiful, his action so spirited and graceful, and at the

same time he is trained to such gentleness, it is not surprising that he has captivated the Eastern mind and has always been an object of love and admiration; nor can they be bought for any trifling sums—for fine horses are fairly high-priced, the best selling from $500 to $700 each.

The meat sold in the general markets is that of the sheep and goat only, for the Mohammedan, though very fond of beef, abhors the flesh of the hog: while with the Hindoo, who delights in pork, the cow is an animal so sacred that it is never muzzled and never molested even in the grain-fields; if a stray cow makes a raid on the basket of a poor Hindoo vegetable seller, though it represents everything he possesses in the world, it is never driven away. But between Hindoo and Mohammedan, it is doubtful if the hog and the cow have any better time in India than elsewhere; for the Mohammedan detests the Hindoo, and the Hindoo as cordially hates the Mohammedan—his former ruler, and the trespassing of the cows of Hindoos upon the Mohammedan lands and their consequent destruction by Mohammedans has frequently led to savage fights and local feuds have not unfrequently extended to widespread, bloody riots.

I visited at Bombay the Parsee College, built and endowed by the only native of Queen Victoria's East India Empire ever knighted—a man of high character and great wealth. The college is of the grade of the average American college, and the branches taught are similar, except that Persian and English are substituted for Greek and Latin. It was to me a surprise and pleasure to hear read Grey's Elegy as distinctly and correctly as if recited by an English scholar. There are in the country a great many schools of all grades, established and maintained by the Government, by natives and by religious denominations of Europe and America. The Mohammedans and Parsees manifest great eagerness to learn, and schools are crowded to excess, thousands being turned away yearly; though caste has a very restraining influence to prevent the education of Hindoos still the novelty of Western ideas, and their fascination to the Eastern imagination, exert a powerful influence in favor of education.

On our way from Bombay to Delhi, in Northern India, we passed through many large cities, stopping at several of the most important a considerable time. We were always received with much ceremony by native and other officials, and taken to every place of interest. At the great cities of Ajmeer and Jeypoor we

were conducted through the royal palaces and shown many works indicative of the wealth, splendor and power of former Rajahs. At Ajmeer, near the palace, is an artificial lake, seven miles long and three wide; its entire perimeter being faced and terraced with beautifully-cut white marble. It receives the drainage of the mountains and is the water supply of the city; in our whole country we have nothing that equals it, either in cost, beauty or extent.

Jeypoor is the capital of the province of Rajpootana, an immense district embracing 15,000,000 of people over whom a Rajah has absolute life-and-death power. There are several similar districts in India permitted by the English Government to remain under the rule of Rajahs, but at their capitols reside representatives of the Viceroy, and their general edicts are subject to modification by the Viceroy in Council, though they maintain their courts, standing armies and all the machinery of rulers.

At the railroad station of Jeypoor we were taken charge of by Government functionaries, escorted to the palace and conducted through the apartments, even those of the Seraglio being thrown open for our inspection, the ladies, of course, being absent. Nothing could exceed the interior in beauty and richness of furnishing. The marble walls of the rooms of royal residence being inlaid with jasper, onyx, cornelian, garnet and amethyst, formed into lovely wreaths and flowers; costly India rugs covered the floors, wonderful tapestries the walls, and works of exquisite art were displayed on every side in lavish profusion. The palace building is quadrangular and incloses a garden of splendid beauty, containing, in all their profusion of growth, every variety of wonderful Oriental flowers and shrubbery. Beyond the palace, at one extremity, is the royal fishing pond; on another side the cages of tigers, and at still another side are the marble stables of the Rajah, containing fifty of the finest Arabian and Persian horses in the world. Here was erected a carpeted dais with comfortable seats, which we were invited to occupy, and the chief of the stable was ordered to exhibit the horses. Their training was something marvelous—in instantly turning, stopping, or lying down from the wildest gallop, at a sign of command; dancing on their hind feet; turning on one foot; running in a circle not over fifteen feet in diameter; and many other things which would have delighted any lover of the horse.

In the city is a native museum and an art school, both under

the patronage of His Highness, the Rajah. The museum is an exhibit of infinite extent and interest, illustrating the progress of India in industries, the arts, and science from early times; and so arranged that a comprehensive relative view of all, at any period is possible. The art school is under the direction of patient, refined, native gentlemen, and the instruction of the many pupils is careful and thorough.

The city of Jeypoor is perhaps, with the exception of Benares —which is the seat of the Hindoo priesthood and religion—one of the most characteristic of the cities of India. Few Europeans reside there, and few visit it; all its thought and character is thoroughly native, and, therefore, it is a typical city of Indian civilization. Its streets are broad, cleanly and shaded; its shops and residences attractive; its temples and mosques beautiful, and its people handsome, well-clothed and orderly. Property and personal safety are secured and the punishment of crime is swift and terrible. A sumptuous dinner, served at Government expense, terminated our stay there, and for one, I left this charming city with great regret.

Arrived at Delhi, we drove at once to the camp of the Commander-in-Chief in India, Sir Frederick Roberts. Then began our camp-life, lasting three weeks in the region of country lying between Delhi and Umballa, a point 100 miles north of the former city. In the permanent camp which we occupied for a few days before and after the maneuvers, were vast double tents floored with rugs and divided by hangings into apartments, and in front of the tent of each foreign officer was displayed the flag of his nation; carriages and servants were always at hand, and each day was a fête day. In the so-called flying-camp, however, during the maneuvers, our daily life was that of active service: small tents, limited personal baggage, pack-animals and starlight breakfasts were the rule. Not so with dinner, however; an army of servants took the burden and care of the great mess tent and its stately outfit, and every evening at eight, a formal dinner of many courses was served, at which were usually seated forty or fifty officers and guests. After dinner, around an immense camp-fire, (for nights in the hill-country are cold, though the days very hot) camp stories, and what are called "Army pegs," carried us usually into the early morning hours. At the termination of the maneuvers we returned to our palatial tents in the permanent camp, and during our stay there were repeatedly honored by

invitations to dine with the Commander-in-Chief, and on his arrival, with His Highness, the Viceroy.

In free converse with English officers, my hitherto ideal of the fierce combats which always attended tiger-hunts was rudely shattered. The hunter is always either on foot or in a houdah on the back of an elephant; if on foot he awaits the tiger, which is started out of the jungle by the beating and shouting of natives, and when the tiger appears the hunter fires, taking care to do so after he has passed: if this precaution is taken the animal rarely turns when wounded, but his flight is hastened, and he is usually killed before getting beyond the circle of hunters. It is quite as dangerous, if not more so, to shoot from the houdah, for the tiger, when wounded, supposes that the elephant is the cause of the trouble, and often springs on his back, and the rest of the tiger-hunting is left to the elephant, who starts on a run shaking himself to get rid of the tiger, and making it very animated for those in the houdah, whose principal business then is laying down and holding on. Sometimes tiger, houdah and hunters are shaken off together, and all parties take to their heels. I met a gentleman in India whose hand was greatly disfigured by a somewhat novel experience with a tiger; he was sitting alone in his bungalow one evening reading, when, hearing a noise, he looked up to see an enormous tiger spring into the room; the tiger at once seized his hand and started toward the entrance, conducting the man with his hand in the tiger's jaw, some rods toward quite a large stream, where his shouting brought the assistance of servants, who shot the tiger, and, supposing it dead, they carried the gentleman back to the bungalow; a moment after reaching it what was the horror of all to see the tiger again enter, but, much weakened from loss of blood, it fell before it had time to attack, and they were gratified to see it die before their eyes.

Delhi is a fortified and gated city, as are also Agra, Lucknow, Jeypoor, and many other former capitals. Their walls are of solid stone-masonry, high, thick and buttressed, and there are, generally, interior citadels covering immense areas, and usually inclosing the Palace and Government administrative buildings. They have ditches, curtains, bastions and outworks, and are, except to modern artillery, places of great strength.

Next to the Taj at Agra, the marble Palace of Pearls at Delhi is the most beautiful building in India. It is of vast size, and encompassed by a graceful peristyle of great height and breadth;

groined and pointed arches, light, perfect, and of exceeding beauty, spring from the columns and sustain the highly ornamented roof. The throne-room and arched corriders leading to it are of marble, inlaid with gems wrought into figures and flowers in intricate profusion. The bath-rooms have high, mullioned windows, with walls ornamented in delicate tracery and graceful figures, sculptured in relief; they are separated from adjoining dressing-rooms by lace-like partitions of marble, cut in exquisite designs, the interstices admitting both light and air. The audience-room is at least one hundred feet long and thirty wide, the ceiling perfectly flat, and composed of broad and heavy white marble slabs, suspended from an arch sprung from the side walls. The royal living rooms are arched chambers, highly ornamented, all in different styles, but with walls everywhere inlaid, and floors patterned in mosaic work. Altogether this royal residence is of marvelous loveliness.

Fifteen miles from Delhi are the ruins of a very ancient city, whose elaborately-carved but crumbling façades, friezes, cornices and columns are strewn over the ground for many miles, though they abundantly indicate a tasteful knowledge of sculpture and architecture.

Similar ruins to those above described, of ancient cities and temples, once magnificent, are more or less common throughout India, and are the measure at once of the long duration and the advanced state of its civilization.

Near these ruins is the celebrated Kootub tower, built 400 years ago; it is 240 feet in height, and, until the completion of the Washington Monument, was the loftiest single column in the world. Its massive stones are apparently laid together without cement, being fastened by dowelling in the most skillful manner. Its base is about forty feet in diameter, and its exterior surface is cut into semi-circular columnar flutings, giving to the whole a novel and beautiful effect. We ascended to the top by a spiral, geometrical staircase, as well constructed and as safe as any in the world. Near this tower and on a steep hill-side, are several great wells, more than thirty feet wide and one hundred deep. Here native boys clamored about us, offering to jump from the top of the wells to the water below, about eighty-five feet, for a very small sum. They were speedily engaged, and we witnessed the extraordinary sight of these boys shooting like rockets, feet first, through the air from this great height.

Near Delhi are the ruins of a great astronomical observatory, built 350 years ago by one of the native rulers, himself an astronomer of no mean pretensions. An immense azimuth circle, of polished stone, divided into sections of 60° each, and a gnomon, thirty feet long, of the great sun-dial, still remain almost perfect. Tables of stars, calculated by natives at this observatory, were some years since compared with those of English astronomers, and were found to be more accurate than those of the latter.

As a mark of special distinction we were permitted to visit the sacred interior of the Jumni Musjed, the great mosque at Delhi; it will probably contain 20,000 worshippers, and is, perhaps, the finest mosque in the world. Here we were shown the sandals of Mohammed; his ring and robe; the imprints of his naked feet made in solid rock; and various other curiosities calculated to stimulate the belief of the faithful and the ridicule of infidels. But whatever form of faith one may entertain, one cannot but be impressed in these vast temples, whether of Mohammedans or Hindoos, with sentiments of profound respect, for they enshrine the purest and most sacred thoughts of hundreds of millions of men, and they reveal the exalted spirit which has inspired the erection of such grand structures for the worship of the Supreme Spirit of the Universe.

After leaving Delhi, we visited successively the great cities of Cawnpoor, Lucknow, Agra, Benares and Allahabad, and at each were greeted with new and strange sights. Each of these great centers presents considerable variation in the customs, dress, and dwellings of the people, and positive departures in the character of their industries. Thus Agra is as famous for stone-carving and inlaid marble, and Benares for perforated and inlaid brass, as is Sheffield, in England, for steel goods, or Worcester for pottery.

At Lucknow is the grave of the lamented Havelock and the governmental residence, which was the place of the desperate and heroic defense of the English garrison of that city when besieged by the native troops during the Sepoy Rebellion in '55. It was to the relief of this garrison that Havelock came, arriving at the last despairing moment, and saving it from destruction.

At Cawnpoor are the Memorial Garden and Monument, testimonials to the memory of those who fell in the frightful massacre there, the result of one of the most extraordinary military blunders in this or any other age. The general commanding the British garrison, after the rebellion had developed into frenzied

strength, insisted upon fortifying and holding the garrison buildings just outside a vast rebellious city, as a place of defense, instead of retiring a few miles to a point of great natural advantages. He was closely besieged; his supply of water was limited, and, as the extent of ground defended was very great for the troops at hand, his lines were weak, and he was finally obliged to surrender on the rebel's own terms. The garrison was, with few exceptions, massacred: and three hundred ladies and children, including many wives and daughters of officers, after being marched about in the burning sun for several days, were one night shut up in an old temple and there butchered, their bodies being thrown into a well now surrounded by the Memorial Garden.

The desperate siege of Delhi by the English during the Sepoy Rebellion of 1855, their final assault of the Cashmere Gate of that city, and their heroic defense of the Residency of the city of Lucknow against the rebels, are portions of the history of the English occupation of India especially blazing with glory. Nothing better illustrates the sublime courage and stubborn perseverance of the Anglo-Saxon race—the one in attack, the other in defense. The battle of Plassy and the conquests of Clive in India pale before the deeds of valor and endurance of individual men and women here enacted—deeds which would have exalted Romans, and illuminated the stories of even their desperate practice of war.

Near Agra are the palace and tomb of the great Akbar, and the famed Taj Mahal, erected to the memory of his wife by the Tartar Emperor, Shah Juhan. The palace is in a huge fort, a mile and a half in circuit, with walls seventy feet high, of red sandstone; a vast court, two hundred feet by sixty, which was once the general audience hall of the Moguls, forms the front of the building. The palace area is a rectangular inclosure about five hundred by four hundred feet, having a floor of white marble surrounded by arcades which open upon a succession of smaller courts; the sub-structure is of red sandstone, but the whole of its body-walls, corridors, chambers and pavilions are of white marble wrought with exquisite elaboration. The pavilions overhanging the river are inlaid within and without in the rich style and not unlike Florentine mosaic, glittering with jasper, agate, carnelian bloodstone, lapis-lazuli, garnet and amethysts. Balustrades of marble cut in open patterns of rich design and resembling fringes

of lace, extend along the edges of the balconies; and from those of the women's apartments are lovely views in every direction of gardens and palm-groves.

The tomb of Akbar is an immense pile of red sandstone almost a palace in size, with a white marble inclosure at the top. Its base is a square of 300 feet and its height over 100 feet. The whole resembles a terraced building of four stories, with a surrounding colonade at each terrace, the top story or inclosed chamber being of pure white marble. The sides of the interior of this chamber, which is 70 feet in diameter, are cloistered arches, and in the middle is the cenotaph corresponding in size with the ordinary burial-casket; the outer walls of the cloisters are formed of marble screens pieced with intricate and highly varied patterns, the floor of the chamber being open to the sky. At the head of the cenotaph is a marble receptacle of the same height, and in it is said to have rested for many years the great Koh-i-noor diamond.

The Taj of Agra, like the tomb of Akbar, stands in an immense garden inclosed by a lofty wall of red sandstone, with arched galleries around the interior. The garden is entered through a superb gateway of sandstone, ninety feet in height, and inlaid with marble on which are cut inscriptions from the Koran. Immediately beyond this is a wide terrace from which is overlooked the great garden, which seems a vast stretch of fountains, lakes and flowers; all varieties of the wonderful foliage of the East have intermingled their branches, and the air is filled with perfume and resonant with the songs of birds; it is a fit setting for that wonder of architecture, the Taj. Its plinth is of white marble, eighteen feet high and three hundred feet square; and at its four corners stand four columns or towers, of black and white marble, each one hundred and fifty feet high, and crowned with a little pavilion. The mausoleum itself is two hundred feet square and two hundred and forty in height to the top of the gilded dome. Four great arches support the whole fabric, one on each front: three are visible, but the fourth is closed in by the hall of entrance and galleries. The exterior and interior are of purest white marble; each of the four corners is cut off, giving to the main building the lightness of an octagon without its solid stiffness. The two cenotaphs are under the arch of the dome, in a chamber, about sixty feet in diameter, octagonal in shape and screened off from a surrounding gallery by a thin wall of marble

lace-work, representing the most beautiful imagery in birds and flowers. Between this gallery and the main wall of the mausoleum are eight cloistered arched chambers, corresponding to the eight outer faces of the building. The face of the entire marble interior of the crypt and these surrounding chambers, is of inlaid work in delicate design, of the kind of precious stones already mentioned. The exterior and interior, in symmetry, material, and ornamentation, are perfect, and the whole effect is fascinating in the extreme.

We witnessed, several times, some of the astonishing feats of Indian jugglers—generally thought too marvelous to be wholly true. They give their performances in the open air, and on the hard ground, unaided by any of the machinery which is usually a feature of such exhibitions. A seed planted in the earth, apparently sprouted, became a plant, blossomed and bore fruit, all within thirty minutes. I was given two balls the size of a hickory nut, to hold in my hand, and myself covered them with a thin wooden cup perfectly empty; on raising the cup a moment afterward I was somewhat surprised to find three balls there exactly like the first. These, and similar performances, witnessed for an hour or so, made me a little nervous and to imagine that I smelled sulphur.

I will describe a trick of Indian jugglers which I heard of but did not see, and therefore will not vouch for it: A man carrying a ball of stout twine and a wooden peg comes along, followed by a child and a woman; he drives the peg into the ground, ties one end of the string to it and throws the ball into the air where, by some power, it is made to stay; the woman then climbs up on the string and disappears out of sight; then the boy follows her and disappears; then the man follows both and likewise disappears. After awhile the man comes down bringing under his arms the pieces of the woman and the boy; he lays them down on the ground, carefully assorts them out and puts them together; then the woman and boy get up, the man pulls up the peg, rolls up his twine and all start off, as though nothing unusual had occurred.

In the murderer's quarter of one of the great prisons which we visited, groups of thugs and stranglers were pointed out. Thugs are robbers who murder from religious motives as well as to conceal the crime of robbery; but the strangler is a high-toned, emotional and enthusiastic follower of the holy mother goddess,

Jay Kalee, the divinity of blood. Killing, with them, is an accomplishment and a pleasure; they have no object but murder, and they expect for their deeds the favor and rewards of the goddess. Their countenances do not indicate the brutality of their calling, but, on the contrary, they are of bland expression and calm placidity. We saw, too, the weaving of the famous India rugs, where twenty men working swiftly nine hours a day, will not finish more than two and a-half yards of carpet; no part is machine work; but every cross-thread is tied in by hand, the pattern being rapidly called by a man sitting near a loom, each workman tying in threads of color accordingly.

The military maneuvers terminated with a grand review by the Viceroy of the two army corps of 40,000 men, which would have been more brilliant and certainly more agreeable but for a tremendous rain that, for four hours, relentlessly poured down upon us. The military formation was on a perfectly level, treeless plain, all the troops being constantly in view, and the whole effect very fine.

The day following was devoted to exhibits of artillery driving, quoit throwing, and the wonderful horsemanship of the Sikhs of Northern India, who are the most accomplished riders in the world; their feats at full speed, in sticking with the lance tent-pegs driven into the ground, in cutting lemons on the ground, in riding bareback, standing up, and even changing horses at full speed, were fine exhibitions of their complete training. In the trials at peg sticking at full speed, Sir Frederick Roberts, the Commander-in-Chief in India, competed, and though fifty-five years of age, he was as skillful as the best.

The quoit of the native Sikh was a former weapon; it is a circular steel blade of about one foot in diameter, the outer edge of which is very sharp. It is thrown by first spinning it rapidly on the fingers, then hurling it by a circular motion of the arm; it flies whirling with great accuracy and swiftness for two or three hundred yards, and will terribly wound whomsoever it strikes.

The average British soldier, "Tommy Atkins," is, like our own, very fond of fun; and I am certain that my interest in seeing whole columns of men, when halted, pelt with stones troops of monkeys in the trees; or chase and kill the wild boars met with, was quite as absorbing for the time-being as the maneuvers. Occasionally a savage boar would be started in the movements of a large body of cavalry, and for a few minutes the

vicinity looked like an animated game of polo, and in a few minutes more like the hostile meeting of two opposition circuses.

On the last day of our camp-life we breakfasted with the Viceroy and his staff; and on the following morning our military party bid farewell to our most generous hosts, and we began our journey to Calcutta.

A MILITARY HERO.

By CAPTAIN JAMES H. HAYNIE,

War Correspondent.

BATTLE-FIELDS have for centuries been the play-grounds and wars the great schools of heroism. One of the most distinguished of English historians says that war teaches men how to die, and familiarizes the mind with the idea of noble actions performed under the influence not of personal interest but of honor and enthusiasm. It is, says he, the heroic self-sacrifice which war elicits that in spite of all the attendant evils invests it with a certain moral grandeur. A battle-field is the scene of deeds of self-sacrifice so transcendent, and at the same time, so dramatic that in spite of all its horrors and crimes it awakens the most passionate enthusiasm. But this feeling produced by the thought of so many who have sacrificed their life-blood for their flag or for their chief, needs some definite object on which to rest. The multitude of nameless combatants do not strike the imagination. They do not stand out, and are not realized as distinct and living figures conspicuous to the view. Hence it is that the most prominent chief becomes the representative warrior in each and every campaign.

The war between Russia and Turkey produced few great leaders, although some of the officers on both sides might be mentioned as splendid representatives of modern valor and heroism. Prominent among these on the Ottoman side were the Pashas Osman and Mukhtar. But the mountain passes in Armenia were more stubbornly and systematically defended than were the hills and valleys of Bulgaria, the rock-ribbed mountains of the Balkans, or the rose-fields of Roumelia, and so it is that the latter

has achieved a reputation which will perhaps live longer in military history than that of the brave defender of Plevna.

The able soldiers in the Russian Service were too long overshadowed by Princes of the Royal blood. It took some time for the Czar to discover that great generals are not made to order. But after sad reverses the Emperor began to recognize merit wherever found, and so it came about that Skobeleff (the younger) and Gourko in Bulgaria, and Loris Mellikoff in Asia Minor were assigned to important commands and numerous victories followed in rapid succession. Of these five, I have mentioned, Skobeleff is to my mind the real hero of the War. What Ney was to Napoleon, what Hill was to Wellington, what Sheridan was to Grant, and Kilpatrick to Sherman that was Skobeleff to Grand Duke Nicholas—the beau-ideal of a soldier of the type which men instinctively recognize as leaders, his efforts will certainly go down in history as among the most brilliant in the late campaign.

He was born a soldier; his father and his father's father were among the bravest in the Russian Army. The story of the family's rise is a curious one. In 1839, after a mimic representation of the battle of Borodino, conducted by 200,000 men in the presence of Emperor Nicholas, his Majesty gave orders to General Skobeleff, of his staff, to pick out the finest men in the forces present to form into a body of Imperial Guards. Almost the first regiment inspected by the General contained a stalwart young fellow surpassing every private in his company by the splendor of his physique. The General stopped and asked this man his name. The soldier replied that it was Kobeloff, and that he had enlisted into the Service from a village in the province of Novgorod. On being told that it was only the youth of Kobeloff which had hindered his advancement from the ranks, the General immediately gave orders that he should be made a non-commissioned officer. The same evening, the General gave a dinner to the officers of the regiment to which Kobeloff belonged, and after his health had been drunk, he arose and said he would tell his guests an anecdote. Many years previously when he was only a private in the Emperor's escort, it had chanced one day that he was stationed on guard in one of the state rooms of the winter palace. While keeping guard the Empress passed by, and after regarding him a few seconds asked him his name. He replied that it was Kobeloff. "Kobeloff," exclaimed the Empress; "I don't like the sound of that name. It does not suit such a brave looking

soldier as you; for the future you are to be called Skobeleff, and if you behave yourself you will never have cause to regret being in his Majesty's service." From that time, the Empress did her best to encourage the rise of the soldier to whom she had taken a fancy, and eventually he became *aide-de-camp* to the Czar. "I have only one more remark to make," added the General, "and that is, the young fellow whom I raised to be an officer to-day is the son of the brother I left at home to look after our parents and the village flocks."

The nephew thus recognized took his uncle's name, and he too subsequently became a General, gaining great renown in Central Asia. He also served with commendable gallantry in the late campaign, and was known in the Army and by the correspondents as Skobeleff the elder, to distinguish him from his heroic son who is the subject of my sketch. Skobeleff the younger has been in every campaign the Russians have had since he was old enough to enter the field. Before the outbreak of the late War he was Governor of the Province of Ferghara. When the Czar gave the order to cross the frontier, he joined the Army unattached, and his position not suiting him he indulged in mad pranks more fit for War in the XVth than in the XIXth century. One day, before the Russians had crossed the Danube, he swam the rapid river on horseback to show it could be done. This and a few other brave deeds brought him to the notice of the Grand Duke, and he was no longer kept idle. He was assigned to active duty at the front, and his talent and knowledge soon made him quite conspicuous in the field. His quick wit, fearless spirit and swift determination soon earned him glory and renown, and won for him the unqualified admiration and approval of all the distinguished gentlemen of the Press at the Russian Headquarters.

Not only was he distinguished for bravery in battle, but he soon showed that he possessed undoubted tactical skill. There was no officer in the Service who sooner saw the weakness or the strength of a position, or better knew how to turn this knowledge to account. Brave almost to recklessness he was none the less careful of the lives of his soldiers; nor could he find it in his heart to send men on death and not dare to share their risks himself. In one of the bold reconnaissances about Loftcha many men were lost, but his orders were imperative to ascertain the force of the enemy as nearly as might be, but not to bring on an engagement. These orders he performed admirably but when the necessary

work was finished he exposed his own life with a bravery almost beyond precedent in order to recall his troops who mistook a demonstration for a real attack. In one of the forays around Plevna, Skobeleff's Cossacks suffered much from thirst. They breasted a high ridge and saw below them a delicious spring, stone-faced and cisterned, as are all springs near the high-way in that land. The General leaped down and very slowly walked to the cistern where Turkish bullets were pattering on the rocks like hail in a heavy storm. He took a long drink, and then another, washed his face and hands shouting to his officers how sweet and cool was the water. The soldiers were mad to see their idol thus run into danger which they themselves seemed to shrink. They clambered out of their saddles and pressed forward, but the danger was too great and Skobeleff ordered them back to a place of safety.

A Major-General at thirty-one of age and a Lieutenant-General at thirty-three, he was in all respects the most popular man in the Russian Army. His earlier services were no less distinguished than his later ones. During 1870 and 1871, when but twenty-seven years of age, he was appointed to proceed with a small force into the provinces of Central Asia to make observation as to the best route for the Khiva Campaign. The young leader made many geographical discoveries, traced the ancient bed of the River Oxus, followed the route traversed by the caravans and carefully marked the position of the wells on the way to Khiva. Nothing was allowed to hinder him from fulfilling his mission. Geographical difficulties were overcome and hostile tribes forced to retire before him. His indomitable will and wonderful energy made success certain. For his services in these years he was made a staff-officer, and given a high command. In the Khiva Expedition of 1873, he was the life and soul of the campaign, and to him was chiefly owing the final success of that movement. At the storming of Khiva, he entered the palace of the Khan at the head of his regiment. For this he received the Order of St. George, Fourth Class, and two years later in the war in Khokand, for distinguished bravery, he was decorated with a higher class of the same military order, was presented with a golden sword and made a Major-General. Early in the late campaign after the Army was south of the Danube, the Czar personally presented Skobeleff with his commission as Lieutenant-General.

A few incidents to show the stuff of which our Russian hero is made. In one of the attacks on Plevna two regiments ordered

to advance were met with such a terrible shower of iron and lead that they faltered. Two other regiments dashed forward to cheer their comrades on, and thus re-inforced the attacking party once more pressed forward. They reached the glacis, but were received with such a storm of bullets and cannon-ball from Osman Pasha's forces that again the Russians showed a tendency to retire. Skobeleff was near at hand and watching every movement of friend and foe. Seeing the critical state of his column he put himself at the head of two battalions of Reserves, and raising himself in his stirrups he waved his sword and shouted "My children, follow me!" The men cheered, descended the slope on the double-quick, commenced the ascent of the hill with redoubled speed and touched the troops in front carrying them along *en masse*. A shell burst beneath the horse which Skobeleff was riding. The steed rolled over dead; but the General, still bearing his charmed life, picked himself up unhurt, though his sword was broken at the middle by a fragment of shrapnel. Waiving the fragment of his sabre overhead he encouraged his soldiers to press forward. The glacis was reached, the ditch was crossed, the parapet mounted, the stronghold was captured, and among the first to jump down into the redoubt was our hero. Skobeleff held the place that night, but the next day it was recaptured by the Turks. During these two days every member of Skobeleff's staff was either killed or wounded, and most of his escort were placed *hors de combat* so desperate was the fighting. He alone was unharmed.

He always rode a white horse when going into battle. During the late war he had no less than seven horses shot under him; but he himself never received a wound. He seemed to bear a charmed life, resembling in this respect Lieutenant-General Sheridan, of our own Army, who in all his years of service and many battles never so much as received a wound or the slightest injury. A correspondent writing from the bivouac before Plevna, November 9, 1877, says: "I have begged the noble Skobeleff not to ride one of his gray horses to-day, but he says that to see him on any other would dishonor his men. 'If I live to another campaign I will not ride white horses, but I cannot leave off now.' These are the calm words of a man who five hours hence is going to what is like certain death."

Last Spring when General Skobeleff marched from Kezanlik, General Gourko was marching upon Phillippopolis. There was

an immense number of refugees from all parts of Bulgaria who fled before the advance of the Russians. A large force of irregular Turkish cavalry overtaken on the plains about Haskoi, and a sharp skirmish followed between them and Skobeleff's advance Guard. During this fight the whole population fled, abandoning their carts, cattle, household goods, everything. The terror being so great numbers of children were abandoned by their parents, many of whom, as well as old people, died of cold and starvation. General Skobeleff searched the plain for these abandoned children and picked up as many as he could find. Almost every trooper had a little child seated on the pommel of his saddle. Skobeleff himself carried two little girls in his arms and brought them on to Hermanli. Here all the children were given in charge to some German ladies of the Benevolent Aid Society.

Skobeleff believes in the power of the bayonet as an auxillary to gunpowder. A few hours before the attack in November on Osman's defences, he said: "This is a new era in war, and we are making experiments for the benefit of others. The shovel and the breech-loading rifle have changed everything. Artillery goes for nothing; the Infantry assault is the only, though the most precarious, mode of success." He had a curious theory that to attack positions one ought to begin late in the afternoon. This makes it, in case of failure, unlikely that the enemy will retort with a counter-attack that night, leaving you the whole night to entrench.

A man of great wealth, and a noble entertainer, Skobeleff was one of the very few Generals who kept open table in the field. All his Brigadiers and Colonels sat at his table twice daily, and Mr. Macgahan, the lamented American Journalist, was ever a welcome guest. He was idolized by his men and loved and respected by his officers. After the Russian forces had camped in front of Constantinople, Skobeleff extended his hospitalities to officers in the Turkish Army, and to Ministers and Consuls of foreign countries stationed at the Ottoman Capital. The English cavalryman, Valentine Baker, perhaps as brave and accomplished a trooper as ever drew sabre in the British Army, was soon on terms of intimacy with his foe from the North, and the accounts of their visits to each other read like romances of the ages of chivalry.

In personal appearance Skobeleff is described as very handsome: Perfectly fair, with moustache and side-whiskers worn in

what was known during the rebellion as the Burnside cut: bold, high features, keen, blue eyes, he would pass everywhere for a brilliant army officer and a perfect gentleman. His smile is full of raillery; his speech has a reckless frankness remarkable in one so brave and soldierly; he is generous, charitable, and free from all jealousies. He never carried a revolver: his only weapon was his sabre and that sometimes laid aside for a riding-whip with a long lash. During the campaign most of the Russian Officers seemed in all ranks to be unconscious of responsibility. They said: "Somebody regulates our lives from the cradle to the grave; we have no voice in any matter. God and the Czar have charge of us; what shall individuals do when they fail?" Unlike those of his fellows, Skobeleff is a firm believer in personal responsibility, and most if not all his success may be attributed to the fact that he was by no means unconscious or indifferent to the responsibilities which were placed upon him from time to time.

MILITARY OPINION.

By CAPTAIN EDWARD HUNTER, U. S. A.,

First Cavalry.

SHOULD an officer of the Army desire to realize how lame and impotent the man felt who kicked the cast-iron dog let him attempt to accomplish something that will benefit the Service and have his efforts opposed by people who live off Government patronage.

The conscientious officer, serving on the frontier, without, it may be, wide and full information on the subject will sometimes honestly believe that even military posts are established and maintained for the exclusive benefit of this influential class.

And what gives sanction to this assumption is the fact that in his experience he has seen sound military opinion and recommendation on this and kindred subjects treated with indifference when they have come in conflict with the personal interests of selfish, cunning, unscrupulous men. In our country due and proper consideration is not given to the opinions and recommendations of military men on military subjects.

It might be thought folly for an officer whose service and experience are restricted to the frontier to attempt to furnish a full and satisfactory answer to a problem which to fully resolve would demand a kind of information, experience, and preparation which he may not possess. But he is not debarred from discussing the question in the light of his experience, however narrow that may be.

> "But nature to no mortal grants
> Knowledge of all things, but to each assigns
> His different part, to thee to fight
> To some deliberate prudence."

The selection and maintenance of frontier military posts belongs exclusively to military opinion and recommendation.

Incontrovertible as this principle seems in theory it is variously illustrated in practice. I can think of no better way to illustrate the practice which obtains than by a description of the most approved method of continuing an effete military post that has literally gone to seed.

A military commander after personal inspection of a military post, or the careful examination of official representations disinterestedly and competently made, decides that no military necessity exists for retaining it as such, but on the contrary that the interest of the Service suffers by its continuance, and he fulfills his duty by taking the necessary and authorized preliminary measures to withdraw the troops and abandon the post. At once a conflict ensues between the best military opinion so expressed and that citizen opinion which is chiefly interested in the Pay, Quartermaster and Subsistence Departments of the Army.

Local interest organizes, avails itself of the right to petition, raises money, secures the influence of the Delegate to Congress, manufactures maps on which trails of savage Indians are represented, and as crossing the limits of the post in question, raises the cry of protection against Indians and calls them merciless when they are raising the wheat that is manufactured into flour and sold to the troops.

Interest so active and so unscrupulous generally prevails and holds the fort.

The question being settled in favor of citizen-interest, money must be expended in repairing old buildings or in constructing new ones. Many of our old frontier forts are so located and built as to be secure only against an enemy armed with bows and arrows. When the Government attempts to rebuild such posts it should take them out of cañons away from commanding hills; in reality give new sites to them and thereby increase expense.

Citizen-interest does not venture to go boldly before Congress and exert its influence to secure an appropriation of money ample to put immediately in repair the post *that* influence has preserved, for the reason that some inquisitive member might ask to see military reports and want to be informed as to military opinion of the necessity of maintaining and rebuilding their post. But it contents itself with the little money that is annually squeezed out to it from the limited allotment to Barracks and Quarters, and is content to see its gratuitous fort built by the

labor of enlisted men in a slow and lingering way that is fatal to their drill and discipline.

Although the rapid, ever-changing order of things on the frontier in a comparatively brief period of time works out and illustrates the truth, wisdom, and economy of those military opinions and recommendations over which citizen-interest was permitted to prevail. Yet such a result does not prevent a younger generation from criticising the work that has been done and designating it as a piece of Army folly and extravagance.

Europe, we read, takes its opinion of military matters through professional soldiers. Such encouragement may have had much to do in developing the talent shown in those valuable, practical, professional papers read before their Service Institutions and republished as notes by our Ordnance Department.

In conclusion, in order that due consideration shall be given, at the proper time to military opinion on military subjects, the writer ventures to suggest that in all instances where such opinion and recommendation individually expressed are at variance with citizen-interest, a Board of experienced officers shall be assembled to examine into all the issues and their report submitted to Congress where the whole matter shall be settled.

THE ASSASSINATION OF GENERAL CANBY.

By LIEUT.-COLONEL H. CLAY WOOD, U. S. A.,
ADJUTANT-GENERAL'S DEPT.

An eagle towering in his pride of place
Was by a morning owl hawked at and killed.

WHILE engaged in a Peace Conference, General Ed. R. S. Canby, then commanding the Department of the Columbia, was treacherously killed by the Modoc Chief Captain Jack and Ellair Man, at 1.12 P.M., the eleventh of April, 1873, at the Council Tent in the edge of the Lava Beds, three-fourths of a mile east of the camp, near the south-west corner of Tule Lake, California.

General Canby left Portland, Oregon, February 8, accompanied by an aide de-camp, Lieut. Harvey R. Anderson, Fourth Artillery for the Modoc country, under instructions from the War Department to confer in person with the Peace Commissioners upon the Modoc question; and was thus cruelly and basely murdered while "endeavoring to mediate for the removal of the Modocs from their rocky fastness on the Northern border of California to a Reservation where the tribe could be maintained and protected by the proper civil agents of the Government.

The Peace Commissioners were Mr. Alfred B. Meacham, of Oregon, the Rev. Dr. Eleazar Thomas, of California, and Mr. Leroy S. Dyer, Indian Agent at the Klamath Agency, accompanied by Frank Riddle and his Modoc wife, Tobe, as interpreters.

The Indians present were Captain Jack, Schon-chin John, Ellair Man (or George),—brother of Shag-Nasty Jim,—Black Jim, —half brother of Jack,—Shag-Nasty Jim, Hooka Jim, Boston Charley and Bogus Charley.

Boston and Bogus had passed the previous night in the camp, Boston breakfasting with Dr. Thomas, and they went with the party to the Council tent, located near the trail leading to the Indians' "stronghold."

At 11.06 A.M., the party started for the tent in single file, and in the following order, viz.: General Canby, Dr. Thomas, and Boston Charley (mounted), some one hundred and fifty yards in advance; Mr. Dyer (on gray horse), Mr. Meacham (on sorrel horse), Tobe (mounted), Riddle and Bogus Charley.

General Canby and Dr. Thomas were not armed.

The proposition for a "talk" had come from the Modocs; and it was agreed that General Canby, Colonel Gillem of the First Cavalry, Mr. Meacham, Dr. Thomas and Mr. Dyer, should meet Captain Jack and four Indians, *all unarmed* at the Council tent.

Colonel Gillem was sick and not able to attend.

General Canby took out, under his arm, a box of cigars, handed one to each Indian, and *all* were smoking, except Dr. Thomas.

After shaking hands all round, they seated themselves for the Council, near by a small sage-brush fire, on the opposite side of the tent from the camp. General Canby was on the right nearest the tent, upon a stone; on his left Mr. Meacham; still to his left and a little in rear Dr. Thomas; and close to Dr. Thomas and slightly in front Tobe, lying down between Mr. Meacham and Dr. Thomas. Opposite to and facing General Canby was Schon-chin John; on his right Captain Jack; and still to his right Bogus and Boston. Mr. Dyer was to the front and a little to the right of General Canby, and to the left and rear of Schon-chin Jack, holding his horse. Ellair Man, Hooka Jim and Shag-nasty Jim were seated at another small fire to the right and rear of Boston Charley. Black Jim walked around the fire and the Council tent, and did not sit down: Riddle was near his wife, Tobe.

The "talk" then commenced; General Canby, Mr. Meacham, Dr. Thomas, Captain Jack and Schon-chin John, making remarks.

Mr. Meacham in his official report says: "Since our arrival at the Lava Bed, the Commissioner, together with General Canby, had labored hopefully, and had apparently gained several points over the Indians looking to a peaceful solution of this question. Until Friday morning, the eleventh instant, we had thwarted all

their schemes of treachery through the fidelity of our interpreter, Mrs. Riddle, a Modoc woman. On that morning terms were agreed upon for a meeting satisfactory to Dr. Thomas and General Canby, though not to Mr. Dyer, nor myself, nor the Modoc woman; General Canby remarking that they dare not molest us because his forces commanded the situation, and Dr. Thomas said where God called him to go, he would go trusting to His care. The meeting was held according to time and place agreed upon. Canby, Meacham, Thomas, and Dyer, and *eight armed* instead of *five unarmed* Indians, as was agreed upon. The 'talk' was short, the Modoc chiefs both saying that unless the soldiers were withdrawn from the country no further talk could be had,—up to that point the Commission re-affirming that the soldiers would never be withdrawn until the difficulty was settled, and still extending the offer of amnesty, a suitable and satisfactory home, and ample provision for their welfare in the future. The reply from both chiefs was, 'Take away your soldiers and we will talk about it.'

"General Canby assured the Indians that he was here for the protection of both parties, and to see that the Commission faithfully fulfilled their promises."

Immediately after Schon-chin John had spoken, and while Riddle was interpreting his 'talk,' Captain Jack rose up, stepped aside, behind Mr. Dyer's horse, and cocked a pistol. Just then the two Modocs, Barncho and Sloluck, suddenly appeared from a ridge of rocks some one hundred yards to the left and rear of the Commissioners, bearing two or three muskets each, followed shortly after by Steamboat Frank and Scar-faced Charley, also armed. Captain Jack returned to within a few feet of General Canby, and exclaiming "A-ta" (all ready) snapped his pistol in the General's face. In an instant he re-cocked his pistol and fired. General Canby fell severely wounded. At once all was confusion. General Canby sprang up and ran past Mr. Dyer's horse, crossing the trail, towards the camp. At the distance of thirty-five paces from where he had been seated, he threw up both hands and fell backward, shot dead by Ellair Man. Both bullets penetrated his head. He was then stripped naked by this Indian and his clothing and valuables removed.

Doctor Thomas was killed by Boston Charley, by a pistol-shot in the breast and a gun-shot in the head. He was stripped by Boston and Steamboat Frank. After receiving the wound in the

breast, and while upon his knees supporting himself with his right hand, he said to Boston: "Don't shoot again, Boston, I shall die any way;" Boston replied, "God dam ye, may be so you believe what squaw [Tobe] tell ye, next time," and shot him through the brain.

Schon-chin John attacked Mr. Meacham, and, assisted by Shag-nasty Jim and Black Jim, pursued and shot him while running. Boston, attempting to scalp him was deterred by the Modoc woman (Riddle's wife) exclaiming, "The soldiers are coming." Meacham received five wounds, from gun-shot and knife, and was left for dead. He was partially stripped.

Mr. Dyer and Riddle attempted to escape toward camp, the former followed and shot at by Hooka Jim and Black Jim, and the latter by Ellair Man, Shag-nasty Jim and Barncho. After running about one hundred and fifty yards, Dyer turned upon his pursuer, Hooka Jim, with a small pocket Derringer, when the Indian retreated.

Mr. Dyer and Riddle escaped unhurt.

Tobe was knocked down by Sloluck but not injured.

The attack was seen from the signal station on the bluff west of the camp, and information immediately conveyed to Colonel Gillem. The troops advanced promptly at the double-quick step, but on arriving at the scene of the massacre the murderers had fled to their "strong-hold" in the Lava Beds.

DISCUSSION OF "ARMAMENT OF THE OUTSIDE LINE."

(*Continued from page 295, No. 34.*)

LIEUT. WEAVER, 2d ARTILLERY.—There are but two points in the comments of Admiral Simpson that take issue with the conclusions of the essay. These are: 1. The Admiral believes that "battle-ships with twenty inches of armor will be very exceptional constructions." 2. He considers that the paper is open to criticism in having omitted to treat of mortar fire.

1. It may be said that a gun capable of destroying such armor, even if twenty-inch armor be exceptional, is desirable, since its "surplus offensive power"—which the Admiral admits is to be desired—will *not* make its capacity of destroying lighter armor, or even twenty-inch armor, depend on "a luckily planted shot."

Without venturing to make an assertion contrary to Admiral Simpson's, it may not be improper to recite the arguments that led to the conclusion, that it appears to be "reasonable to assume twenty inches of steel armor as the limit" at which there is "a tendency to stop." [Essay, page 179.]

The *Trafalgar* and *Nile*—England's latest battle-ships—have 20-inch compound armor. (A belt 230 feet long; the 20-inch plates rising in center to form the walls of a citadel above.) France's latest constructions—*Amiral Duperré*, *Amiral Boudin*, *Indomptable*, *Caimon*—carry water-line belts; the first four of 21.6-inch armor, the last four of 19.6-inch armor. Italy goes to even greater extremes: the *Rè Umberto* and *Sicilia*, now building, will have 29.5-inch steel armor.

These three nations lead the world in naval matters; it was thought that their latest practice might fairly be taken as an index of what is just ahead of us in naval constructions.

2. The failure to treat of mortar fire was designed, not accidental. The treatment of guns and mortars for purposes of defense seemed to be so essentially distinct as to demand separate consideration. The limits of the Essay did not permit this for both. Therefore, at the outset, immediately following the two main divisions of the argument (on page 171) it was definitely stated that attention would be confined "*to the direct fire of guns solely.*" The same statement is repeated on page 189 in beginning the application of the deductions to the coast-line. The fact that mortar fire was not treated of ought not to be taken as an argument against its use, or as implying that mortar fire is not useful.

In accordance with Captain Mahan's suggestion the "dangerous space" covered by a 20-inch projectile at six miles' range is herewith given. Assuming the initial ballistic conditions as given in the Essay, and assuming, further, that the ship's deck is twenty-five feet above water, and that her side is vulnerable five feet below water-line, the dangerous space would be 137.5 feet in length.

This *horizontal* area ought to be kept in mind in comparing the area of target exposed to horizontal and vertical fire, respectively, when the object fired at is a ship at four to six miles' range.

The angle of fall of the 20-inch projectile at six miles is about 12 degrees and 5 minutes; its remaining velocity will be 1395 f. s.; its horizontal velocity will be about 4.25 times its vertical velocity.

Thanks are due Captain Mahan for clearly stating the fact that all plate trials are arranged to favor the gun; it is an argument in support of the Essay's estimate of armor strength and gun-power needed in coast defense.

Gen. Abbot's strictures are entitled to special consideration. He leads the most scientific corps of our Army in questions of coast defense, is an acknowledged authority here and elsewhere, and has, as he expresses it, "Worn the Red in War." Gen. Abbot says that the Essay rejects "principles now recognized by the military engineers of all nations." It is a matter of regret that none of these are specified, for it is quite impossible to meet so general a charge; it is reassuring to find that the able and experienced officers of the Army and Navy associated with Gen. Abbot in the discussion, overlooked so radical a fault.

The General says further: "He" (Lieut. Weaver) "believes that they" (guns for outside line) "ought to be able to pierce twenty inches of steel armor at a range of six miles." It is not easy to find the germ of this statement in the paper, which distinctly puts the matter substantially as follows:

(a) Shore guns must be able to hold off all possible naval guns to a point beyond their extreme range from the city being defended." (p. 170 of Essay.)

(b) If a ship be protected by armor, the gun must have the power to overmatch the armor up to the limit of shelling range from the city (p. 171 and 186, Essay). This, as a rule, will be from two to four miles off shore, along our north-eastern coast-line.

These are fundamental principles. But the *size* of the gun required for coast defense comes more directly from the operation of other factors, *viz.*:

(c) It is admitted that "shore fire must be of a higher power than ship fire." The Essay shows that eighteen inches is a reasonable maximum limit to assume for the caliber of ship guns. Commander Sampson confirms this in his comments. Any caliber larger than 18-inch, therefore, would answer for coast defense, since such a caliber would also satisfy "(a)" and "(b)" above.

There is, however, another principle which enters in determining the limit of size, to wit:

(d) "We ought to mount on the outside line the highest power-gun the manufacturing ability of the time can produce." (p. 179, Essay.)

The 20-inch gun is assumed *because it can be made*, and because it gives shore-fire a *reasonable surplus of power over ship-fire*. As a matter of fact, 20-inch guns *will* destroy 20-inches of steel armor at range of six miles, but much of this—two to four miles of it—is surplus power; practical artillerists will not oppose the gun because it possesses this, nor will legislators, as they will readily discover the economy, effectiveness, and long, if not permanent superiority of such guns over armor.

"The largest gun possible is a time-honored maxim of the Engineer Corps" (p. 22 Abbot's "Defense of the Sea-coast of the United States"). The Essay is in entire accord with this maxim.

Gen. Abbot charges the paper with "underestimating the power of modern artillery." It is not clear how he arrives at this conclusion. Pages 184–5 of the Essay are devoted to an argument for higher gun-power than is now generally admitted. On page 182, the Essay credits the 16-inch gun of the Fortification Board with a higher power than the General himself ventured to give it, or will likely consent to. It was

the intention, that, above all, the Essay should not be open to this particular criticism.

It is impossible to do otherwise than take direct issue with the statement that the paper "wholly ignored recent progress in plate and projectile manufacture."

The list of plate trials given in the Essay, on which the estimate of armor strength is based, includes, it is believed, the best and most trustworthy competitive government tests up to the date of the paper.

According to the Naval Intelligence Bureau—than which there is no better authority in this country—there were no competitive plate trials during the years 1886–7; there were, to be sure, occasional non-competitive tests by plate-makers and by projectile-makers, but these are not, generally, considered trustworthy, as they are usually conducted in the interest of the plate or projectile, depending on the business of the experimenter.

There were, also, some single non-competitive tests of projectiles at Gâvre, (p. 318, Naval Intelligence Pub., No. vi.,) but neither are these entitled to that high measure of credit that is given to those regular government competitive tests that are undertaken from time to time to test the status of the Gun *vs.* Armor question.

The example of the 16.5-inch St. Chamond projectile is believed to be one of the Gâvre tests referred to above. The example of the 8-inch Krupp projectile, which perforated 16-inches of compound armor, is believed to have taken place at Meppen on the 8th of last March, under the direction of, and in the interest of the Krupp firm: it smacks decidedly of advertisement.

These are the only examples cited by Gen. Abbot.

The only entirely trustworthy steel and compound armor competitive tests that have been undertaken since the tests at Spezia, in October and November, 1884 (p. 186–7 Essay), are those now in progress at Portsmouth, England, on board *The Nettle*. This most recent exhibit of the relation between plates and projectiles does not support Gen. Abbot. In the *Army and Navy Journal* of May 26th, will be found diagrams, reproduced from photographs, showing the superiority of 10-inch compound plates over 6-inch Holtzer steel projectiles.

For plate trials prior to 1886, the Report of the Senate Committee on Ordnance and War Ships, the Report of the Fortification Board, and Lieut. Very's "Development of Armor for Naval Use," were consulted. It is believed the selections made from these sources are fairly made, are applicable to-day, and reasonably support the argument of the paper.

Gen. Abbot objects to conclusions as to accuracy of artillery fire drawn from data obtained in range practice. But he himself has developed an elaborate system of defense by mortar fire, based on this same kind of data. In truth, data of this sort is the only available basis for such deductions. Practice in action, will, of course, be less accurate than range practice: horizontal fire will require, relatively, a smaller correction in passing from range to battle-practice than vertical fire. Artillerymen of to-day will not object to the estimate of accuracy of fire which the Essay makes.

Gen. Abbot claims for vertical fire, when ships at two to four miles' range are the target, "double the area of target," presented to horizontal fire. In doing so, he neglects to credit horizontal fire with the *horizontal dangerous space* already mentioned; the actual conditions are, rather, the reverse of the General's statement.

The Essay does *not* "entirely condemn and even ignore the plan of defense against distant bombardment recommended by the Fortification Board," which is "instead of attacking the side of a ship," to assail the deck. The author regrets, sincerely, that any member of the Board should have felt that he intended to do so. It has been explained already why mortar fire was not treated of in the Essay. The Report of the Fortification Board does not entrust the defense against long range bombardment

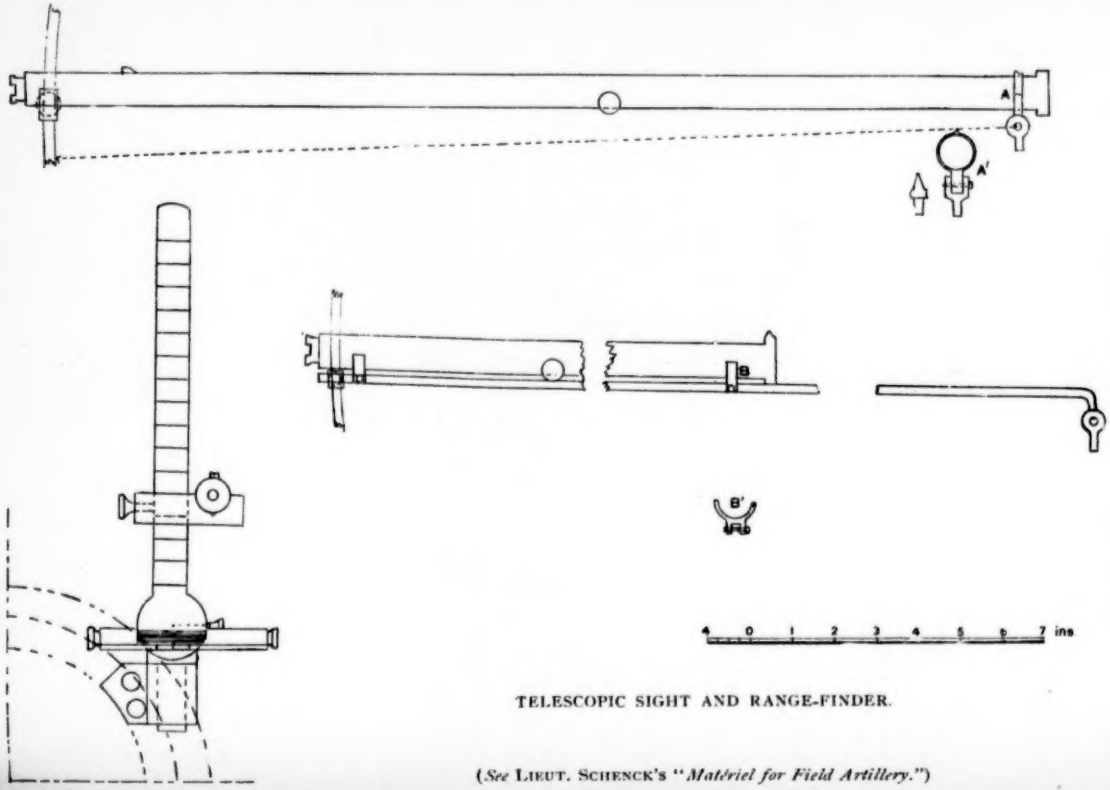
entirely to mortar fire, as Gen. Abbot implies. Such a proposition would not be considered a moment by Artillerymen. The true principle is that laid down by Gen. Abbot in his War College lectures, where in giving "the elements of a first-class system of defense" he places, "first: *high-power guns and mortars for keeping the armored ships of the enemy at a distance.*"

Gen. Abbot compares the fire of groups of mortars with the direct fire of guns and draws the simile that the former is like shooting with a shot-gun at a small object, such as a bird, while the latter is like using a rifle at the same. He has used this simile before and it seems to be a favorite with him in treating of this subject. It is thought, however, that most sportsmen would prefer taking the chances of hitting, let us say, a duck at 200 yards with a rifle, by direct fire, than undertake to drop shot on the duck's back by firing a shot-gun into the air at the mortar angles of elevation, 40 to 60 degrees, granting, for the sake of argument, killing-power to the shot if they struck. Moreover, the nearer the duck, the harder the task.

Practical artillerymen will not, as a rule, share Gen. Abbot's sanguine estimate of the efficacy of mortar fire.

Penobscot Bay is more important to England, in case of war, than Hampton Roads. It *can* be closed by fire from shore emplacements, and many, it is thought, will continue to believe that this should be done.

Commander Sampson asks the question: "Why stop at the conception of 20-inch guns?" he himself has answered this: he says, "most naval officers feel that the practical limit has been reached in the size of guns *for ships.*" That limit is about 18-inch caliber. On shore a higher-power gun is demanded; any of larger caliber than 18-inch will *answer*; but, since a 20-inch gun *can be made*, it is *preferred*, because it is within reasonable limits as to dimensions and will give a large *surplus of power in favor of land defense.*



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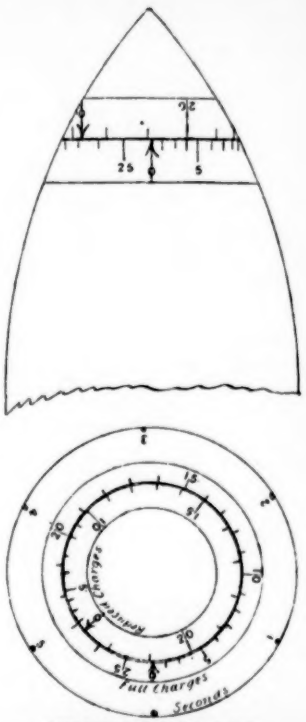

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An Abridgment of the first seven of Prince Hohenlohe's Letters upon Artillery. By Captain G. Toutee, 12th Regiment of French Artillery, together with the seventeenth letter from the French translation and Hohenlohe's recent eighteenth letter from the original German. Translated by William L. Haskin, Major 1st Artillery.

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Brigadier-General S. V. BENET, U. S. A.
Brigadier-General JOHN GIBBON, U. S. A.

Bvt. Brig.-General THOMAS M. VINCENT, U. S. A.

Secretary.

Bvt. Brig.-Gen. THEO. F. RODENBOUGH, U. S. A.

Treasurer.

Lieut. E. R. HILLS, 5th U. S. Artillery.

Asst. Secretary.

Lieut. E. R. HILLS, 5th U. S. Artillery.

Vice-Treasurer.

Lieut.-Col. HEMAN DOWD, 12th Regt., S. N. Y.

Executive Council.

("Six members to go out by rotation biennially.")

(2 years.)

1. ABBOT, H. L., Col. Corps Engineers, B-G.
3. COOK, G. H., Captain A. Q. M.
2. HEGER, A., Lieut.-Col. Med. Dept.
4. JONES, R., Colonel, Inspector General.
5. MORDECAI, A., Lieut.-Col. Ordnance Dept.
6. O'BEIRNE, R. F., Lieut.-Col. 15th Infantry.

(4 years.)

7. BREWERTON, H. F., Captain 5th Artillery.
8.
9. HAMILTON, JOHN, Colonel 5th Artillery.
10. JACKSON, R. H., Major 5th Art., B.-G.
11. RANDOLPH, W. F., Capt. 5th Art., M.
12. BLISS, T. H., 1st Lieut. 1st Artillery.

(6 years.)

13. SUTHERLAND, C., Colonel Medical Department.
14. TOMPKINS, C. H., Colonel A. Q. M. G., Bvt. Brig.-Gen.
15. WALLACE, G. W., Lieut.-Colonel, U. S. A. (retired).
16. WEBB, A. S., Bvt. Major-General, (late) U. S. A.
17. WHEELER, H. W., 1st Lieutenant 5th Cavalry.
18. WHIPPLE, W. D., Colonel A. G. D., Bvt. Major-Gen.

Finance Committee.

Generals FRY, RODENBOUGH and WEBB.

Publication Committee.

Generals ABBOT, RODENBOUGH, Col. MORDECAI and LIEUT. BLISS.

Committee on Library and Museum.

General TOMPKINS, Colonel JONES and Lieut. VODGES.

Memorandum.

The Military Service Institution has published the thirty-fifth number of its Journal of Transactions: containing the Prize Essays and other Papers submitted to the Institution; an account of its Origin and Progress, and a Catalogue of the Museum. It offers a Gold Medal and Life Membership annually, for the best Essay on a given theme. The War Department has authorized the occupation of commodious rooms on Governor's Island for its Library and Museum, and has ordered the Quartermaster's Department to transport, without expense to the Institution, contributions of books, trophies, or curious relics. The Institution corresponds and exchanges publications with the principal military societies at home and abroad.

Membership and Dues.

(1) "All Officers of the Army and Professors of the Military Academy shall be entitled to Membership *without ballot* upon payment of the Entrance Fee."

(2) "Ex-Officers of the Regular Army, in good standing and honorable record, shall be eligible to full Membership of the Institution, *by ballot* of the Executive Council."

(3) "Officers of the U. S. Navy and Marine Corps shall be entitled to Membership of the Institution, *without ballot*, upon payment of the Entrance Fee, but shall not be entitled to vote nor be eligible to office."

(4) "All persons not mentioned in the preceding sections, of honorable record and good standing, shall be eligible to *Associate Membership by a confirmative vote of two-thirds* of the members of the Executive Council present at any meeting, *provided*, however, that the number of these Associate Members shall be limited to two hundred. Associate Members shall be entitled to all the benefits of the Institution, including a share in its public discussions; but no Associate Member shall be entitled to vote or be eligible to office."

Membership dates from the first day of the calendar year in which the "application" is made, unless such application is made after October 1st, when the membership dates from the first day of the next calendar year.

All persons eligible for Membership are urged to join at once, and are urged to recruit for an Institution which has the Military interests of the country at heart.

"*An Entrance Fee of Five Dollars* ($5) shall be paid by each member and Associate Member on joining the Institution, which sum shall be in lieu of the dues for the first year of membership, and on the first day of each calendar year thereafter a sum of not less than *Two Dollars* ($2) *shall be paid as annual dues. Annual dues* commence on January 1st in each year, and are paid in advance.

PRIZE ESSAY—1888.

I.—The following Resolution of Council is published for the information of all concerned :

Resolved, That a Prize of a Gold Medal of suitable value, together with a Certificate of Life Membership, be offered, annually by THE MILITARY SERVICE INSTITUTION OF THE UNITED STATES for the best essay on a military topic of current interest ; the subject to be selected by the Executive Council and the Prize awarded under the following conditions :

1. Competition to be open to all persons eligible to membership.*

2. Each competitor shall send three copies of his Essay in a sealed envelope to the Secretary *on or before September* 1, 1889. The Essay must be strictly anonymous, but the author shall adopt some *nom de plume* and sign the same to the Essay, followed by a figure corresponding with the number of pages of MS.; a sealed envelope bearing the *nom de plume* on the outside, and enclosing full name and address, should accompany the Essay. This envelope to be opened in the presence of the Council after the decision of the Board of Award has been received.

3. The prize shall be awarded upon the recommendation of a Board consisting of three suitable persons chosen by the Executive Council, who will be requested to designate the Essay deemed worthy of the prize ; and also in their order of merit those deserving of honorable mention.

4. The successful Essay shall be published in the Journal of the Institution and the Essays deemed worthy of honorable mention, shall be read before the Institution, or, published, at the discretion of the Council.

5. Essays must not exceed twenty thousand words, or fifty pages of the size and style of the Journal (exclusive of tables).

II.—The Subject selected by the Council for the Prize Essay of 1888, is

"THE DANGER TO THE COUNRTY FROM THE LACK OF PREPARATION FOR WAR."

III.—Due announcement will be made of the composition of the Board of Award.

THEO. F. RODENBOUGH, *Secretary.*

GOVERNOR'S ISLAND.

* "All officers of the Army and Professors at the Military Academy shall be entitled to membership, *without ballot*, upon payment of the entrance fee. Ex-officers of the Regular Army of good standing and honorable record shall be eligible to full membership of the Institution *by ballot* of the Executive Council.

"Officers of the United States Navy and Marine Corps shall be entitled to membership of the Institution *without ballot*, upon payment of the entrance fee, but shall not be entitled to vote, nor be eligible to office.

"All persons not mentioned in the preceding sections, of honorable record and good standing, shall be eligible to Associate Membership *by a confirmative vote* of two-thirds of the members of the Executive Council present at any meeting, *provided*, however, that the number of these Associate Members shall be limited to two hundred. Associate Members shall be entitled to all the benefits of the Institution, including a share in its public discussions, but no Associate Member shall be entitled to vote or be eligible to office."